ELECTRICAL WORLD

McGRAW-HILL PUBLISHING COMPANY, INC. · NEW YORK CITY · ONE DOLLAR PER COPY

THE INDUSTRY TODAY

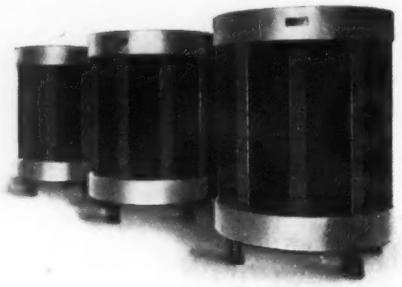
What is the status of the industry today — what are the trends — what are the prospects?

In this issue, in co-operation with recognized leaders in the public utility business, we present the current views on these questions.

This E. E. I. Convention Issue is offered in the hope that it will be of assistance in solving some of the many problems which confront the industry today.

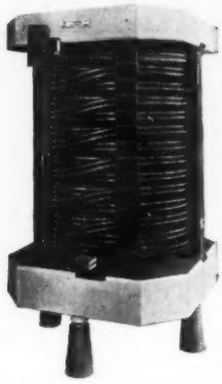
MAY
23
1936

E. E. I. CONVENTION NUMBER

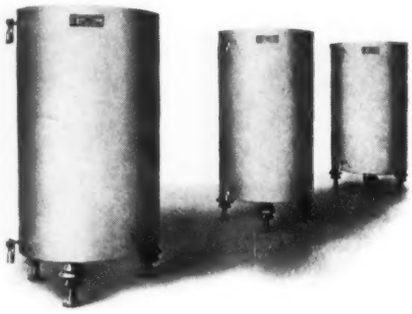


1336 K.V.A., 4060 Ampere, 11.4 K.V., 25 cycle indoor service, open type, fireproof construction.

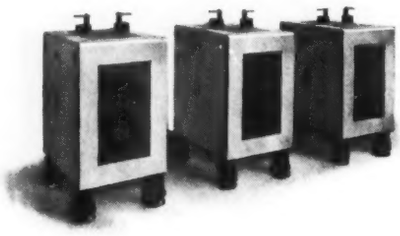
Special fuse testing reactor. Maximum short time rating 3000 Ampere, 12 K.V., 60 cycle, 6 tap variable reactance.



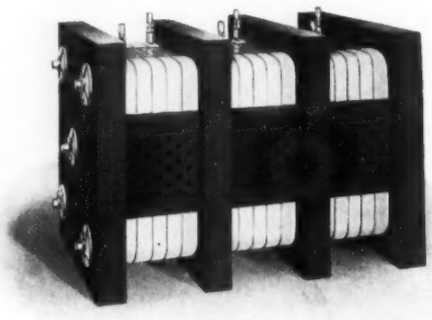
1125 K.V.A., 3000 Ampere, 12 K.V., 60 cycle indoor service, open type, fireproof construction, special design to meet customer's space allotment.



277 K.V.A., 600 Ampere, 16 K.V., 50 cycle outdoor service, dry type, all enclosed reactors.



162 K.V.A., 500 Ampere, 6.6 K.V., 25 cycle indoor service, enclosed type, fireproof construction.



36 K.V.A., 100 Ampere, 4.15 K.V., 60 cycle, 3 phase indoor service, enclosed type, fireproof construction.

MURRAY LOW LOSS REACTORS

Dry type reactors for line voltages up to 33 K.V. for indoor or outdoor installation—as large as 5,000 amperes. as small as .4 K.V.A.

When in need of reactor protection send us your inquiries.

Efficiencies guaranteed.

Metropolitan Device Corporation
Brooklyn, N. Y.

PARTIAL LIST OF INSTALLATIONS

Northern States Power Co.
New England Power Co.
Long Island R. R. Co.
Pan American Petroleum Co.
Westchester Lighting Co.
Shawinigan Hydro Elec. Pr. Co.
Bronx Gas & Electric Co.
Carnegie Steel Co.
Utica Gas & Electric Co.
Standard Oil Co.
Calco Chemical Co.
Brooklyn Edison Co.
Consol. Gas, Elec. Lt. & Pr. Co.
Edison Electric Illuminating Co.
Interborough Rapid Transit Co.
N.Y. & Queens Elec. Lt. & Pr. Co.
Hydro Electric Pr. Comm. of Ont.
Victoria Falls & Transvaal Pr. Co.
Havana Elec. Light & Power Co.
New York Power & Light Co.
Cataluna Power Co., Spain
Northwestern Electric Co.
Southern California Edison Co.
Stone & Webster Properties
New York Dock Co.
Potomac Electric Co.
Tennessee Power Co.
United Electric Light Co.
Union Gas & Electric Co.
Yonkers Electric Lt. & Pr. Co.
Dayton Power & Light Co.
Commonwealth Edison Co.
Detroit Edison Co.
New York Edison Co.
Philadelphia Electric Co.
Southern Wisconsin Pr. Co.
Kansas City Pr. & Lt. Co.
Syracuse Lighting Co.
Columbus Ry. Pr. & Lt. Co.
Public Service Co. of No. Ill.

ELECTRICAL WORLD

FOUNDED IN 1874 ✦ ✦ READ BY ELECTRICAL MEN FOR SIXTY YEARS

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H. G. DOOLEY, Associate Editor
W. K. BEARD, Jr., Manager
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HOWARD EHRLICH, Vice-President
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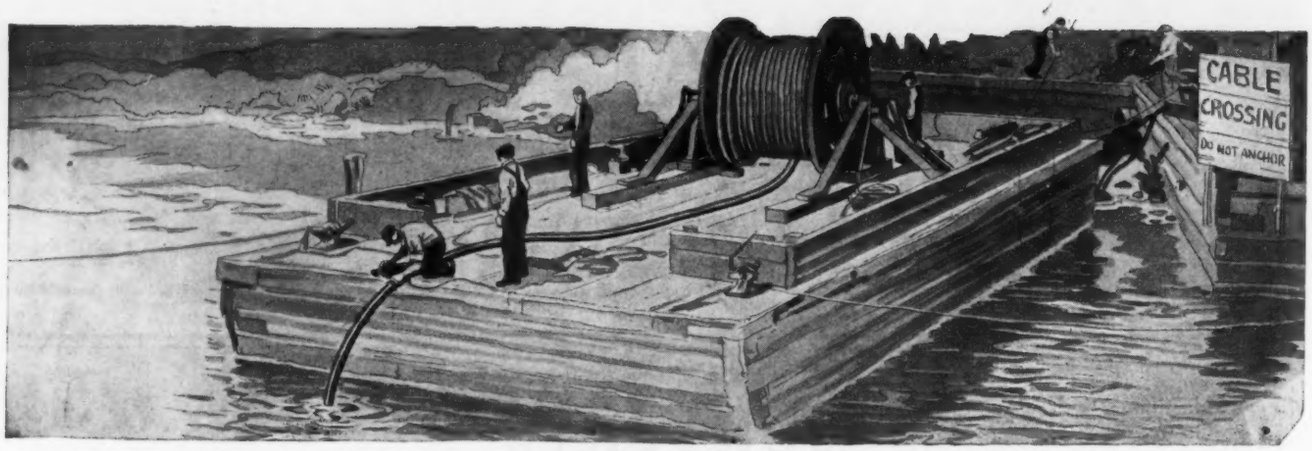

The Obvious Need of Reliability in Submarine Cables

Confidence *must* be placed in submarine power cables. Inaccessible to repairs, carrying important loads, these under-water cables must be reliable.

The manufacture of submarine power cables (rubber-insulated cables by Okonite and impregnated paper-insulated cables by Okonite-Callender) has long been an outstanding specialty of our plants. Our submarine power cables of all sizes and voltages, and in extraordinarily long, continuous lengths, have been supplied for many important installations.

Consideration of this manufacturing experience is recommended to prospective purchasers of submarine power cables.

We invite inquiries and offer our engineering service on specific problems.

THE OKONITE COMPANY

Founded 1878

and

HAZARD INSULATED WIRE WORKS DIVISION

THE OKONITE-CALLENDER CABLE COMPANY, INC.

EXECUTIVE OFFICE: PASSAIC, N. J.

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Boston
Pittsburgh
Seattle

Wilkes-Barre, Pa.

Chicago
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Dallas

Detroit
San Francisco
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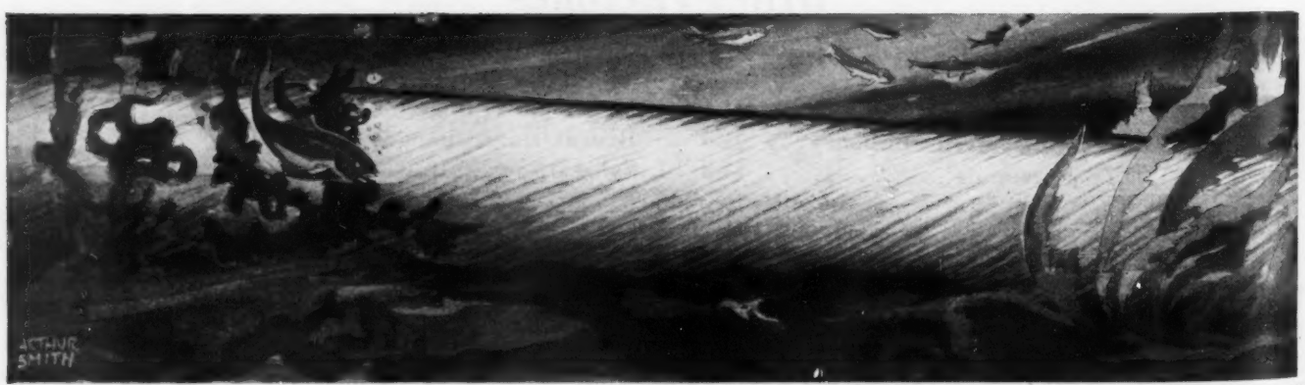


OKONITE QUALITY CANNOT BE WRITTEN INTO A SPECIFICATION

Significant . . .

of the trend in central station boiler buying are these projects awarded to COMBUSTION ENGINEERING

during the past six months

***APPALACHIAN ELECTRIC POWER CO.,** Logan, W. Va.*
One unit: capacity — 1,000,000 lb; design pressure — 1425 lb; total temperature — 925 F

DETROIT EDISON CO., *Conners Creek Station*
Two units: capacity — 392,000 lb each; design pressure — 710 lb; total temperature — 850 F

***KANSAS CITY POWER & LIGHT CO.,** Northeast Station*
One unit: capacity — 300,000 lb; design pressure — 1400 lb; total temperature — 815 F

***MISSOURI POWER & LIGHT CO.,** Jefferson City, Mo.*
One unit: capacity — 100,000 lb; design pressure — 900 lb; total temperature — 825 F

***NEBRASKA POWER CO.,** Omaha Steam Station*
One unit: capacity — 275,000 lb; design pressure — 1350 lb; total temperature — 910 F

***NEW YORK EDISON CO.,** Waterside No. 2 Plant*
Two units: capacity — 500,000 lb each; design pressure — 1400 lb; total temperature — 900 F

***ROCHESTER GAS & ELECTRIC CORP.,** Station 3*
One unit: capacity — 250,000 lb; design pressure — 750 lb; total temperature — 750 F

***UNITED LIGHT & POWER ENGINEERING & CONSTRUCTION CO.**
Riverside Station, Davenport, Iowa
One unit: capacity — 225,000 lb; design pressure — 900 lb; total temperature — 825 F

***UTAH POWER & LIGHT CO.,** Provo Steam Electric Station*
One unit: capacity — 200,000 lb; design pressure — 450 lb; total temperature — 760 F

***VIRGINIA ELECTRIC & POWER CO.,** 12th St. Station, Richmond, Va.*
One unit: capacity — 450,000 lb; design pressure — 925 lb; total temperature — 835 F

VIRGINIA PUBLIC SERVICE CO., *Alexandria, Va.*
One unit: capacity — 60,000 lb; design pressure — 725 lb; total temperature — 750 F

★*Complete CE units — boiler, furnace, firing and in most cases heat recovery equipment.*

C-E

COMBUSTION ENGINEERING COMPANY, INC.

200 MADISON AVENUE, N. Y.

A-281

Number Three

HEAT

of a series of advertisements in which subjects of current interest to utility engineers and consultants are briefly reviewed and present trends indicated. Subjects to be covered are listed below but deviations may be made either in sequence of list or titles.

Superposition

Furnace Design

Heat Recovery

Heat Cycles

Boilers for High Pressures and Temperatures

Availability of Modern Boiler Units

Reprints of this series will be mailed to those requesting them

C-E

THE available heat in fuel, as determined by complete combustion in a calorimeter, includes the latent heat of evaporation of moisture. With heat value thus determined, the maximum overall efficiency which can be economically attained by modern steam generating units is in the range of 85 to 90 per cent.

Although a steam generating unit with its associated heat recovery equipment may be compared to a fuel calorimeter, it cannot be commercially designed to give equal efficiency. This is so because the heat loss due to production of steam from moisture in the fuel and from the combustion of hydrogen is unavoidable. With bituminous coal this may amount to 4 per cent or more, and with oil to over 7 per cent.

By using the lower or net heat value of fuel, as is done in European practice, the above-mentioned efficiency range would be of the order of 89 to 94 per cent. The differences between these figures and 100 indicate the practical magnitude of the combined combustion, radiation and sensible heat losses. Only the last of these can be further reduced by "heat recovery" in the ordinary sense of the term, that is, by the use of an air preheater, an economizer or both.

Fifteen years ago air preheaters were virtually non-existent in American practice and such economizers as had been installed were of the now obsolete cast-iron construction. Today it is common practice to include either an air preheater or a steel-tube economizer or both in all steam generating units of moderate size or larger. As a result, average efficiencies have increased 5 to 15 per cent.

With operating pressures above 600 lb, boiler exit gas temperatures of well over 700 F at normal load are common. Very often, depending upon the type of boiler, the most economical overall design may result in boiler exit temperatures above 900 F. In neither case would an economizer alone be able to reduce the gas temperature to the minimum practical point (about 350 F at normal load) with the feedwater temperatures generally encountered. With economizer feedwater at 300 F, the economic minimum gas temperature would be about 500 F and an air preheater also would be required. Except in stoker installations, the best practice is to install a larger air preheater than would be necessary to effect the 200 deg gas drop and to use only sufficient economizer surface to accomplish the required gas drop between the boiler and the largest size air preheater that can be economically installed.

For stoker-fired units in cases where only moderately high efficiency can be justified, an economizer alone is generally more economical due to the limitation of stokers with respect to preheated air temperature. Where high efficiency can be justified, air preheater as well as economizer surface is required.

Many variables are involved in the determination of minimum economic gas temperature leaving the air preheater, some of which are: cost of fuel; kind of fuel; load factor; range of load variation; minimum winter air temperatures; importance

of availability; ease of replacement of surface; cost of replacement of surface, etc. Determining that proportion of boiler, air preheater and economizer surface which will give optimum results in any given case is accomplished by experimental evaluations of different combinations until the most economical one can be established. The wide variation in the conditions governing each case makes this procedure the only practical one. It requires skilled analysis predicated upon extensive experience and the availability of considerable performance data.

Maximum obtainable efficiencies in the neighborhood of 90 per cent can be economically justified for conditions of base load operation with high load factor and fairly high fuel cost. For average conditions, maximum economic efficiency is in the range of 84 to 87 per cent.

A major limiting factor in heat recovery is the necessity of keeping final gas temperatures high enough to prevent corrotion of heating surfaces. Although the dew-point of water vapor in the gases may be as low as 120 F, if oxides of sulphur are present an exit gas temperature of about 350 F may be necessary to avoid condensation of acid and consequent corrosion. Even where the use of corrosion-resisting metal can be economically justified, there still remains an operating problem due to the presence of liquid which accelerates ash accumulation. A point of importance in this connection is that the metal temperature may control condensation of acid. Dirty areas on heating surfaces can cause a gas film to stay in contact with the metal long enough to reduce the local gas temperature to the dew-point even though the average gas temperature leaving the equipment may be well above that point. With air preheaters it is sometimes practical to recirculate a portion of the heated air at low ratings to prevent corrosion.

To avoid internal corrosion in economizer tubes, the use of a deaerating heater is necessary. This results in feedwater temperature entering the economizer at 212 F or higher. Since the minimum practical temperature difference between gas leaving an economizer and entering feedwater is about 200 F, it is therefore not possible to reduce exit gas temperature with an economizer alone below about 400 F.

As has been indicated, it is possible today to obtain overall efficiencies, calculated on the more practical lower or net heat value, of 90 to 94 per cent. Therefore it may be said that no appreciable improvement is possible until the sulphur content of coal can be removed before burning, or until materials capable of resisting corrosive sulphur compounds become economically available.

COMBUSTION ENGINEERING COMPANY, INC.

A-279

200 MADISON AVE. NEW YORK

CE PRODUCTS

BOILERS
Sectional Header
Box Header
(two types)
Bent Tube
(four types)
Fire Tube
(four types)
Marine
(all standard types)
Electric
(Included in above list are all types known by the trademarks Heine, Walsh-Weidner, Casey-Hedges *and* Ladd*)*

STOKERS
Multiple-Retort Underfeed
Single-Retort Underfeed
(five types)
Traveling Grate
(two types)
Chain Grate
(three types)
(Included in above list are all types known by the trademarks Coxe, Green, Type E, Type K *and* Skelly*)*

PULVERIZED FUEL SYSTEMS
(for boilers and industrial furnaces)
Storage
Direct Fired
(CE Pulverized Fuel Systems, formerly known as Lopulco, *include* Raymond *Pulverizers)*

FURNACES
Dry Bottom
Slagging
Water-Cooled Walls and Screens

COMPLETE UNITS
Two standard designs, one for large plants and the other for medium-sized and smaller plants

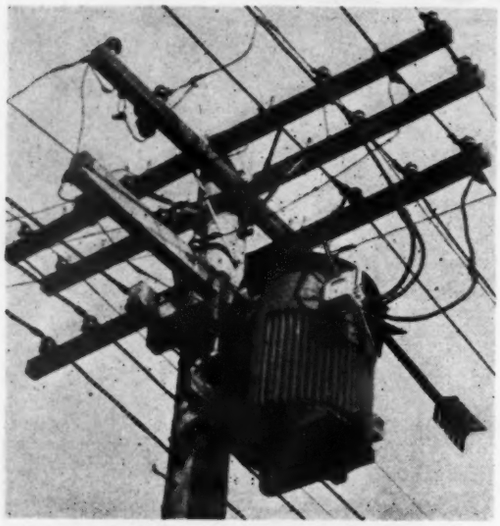
•

Coordinated designs comprising any combination of boiler and firing equipment

ALLIED EQUIPMENT
Air Heaters
(Regenerative, Plate and Tubular Types)
Economizers
Oil Burners
Ash Conveyors
Ash Hoppers

Get the most out of YOUR DISTRIBUTION TRANSFORMERS

CHECK MAXIMUM DEMAND ACCURATELY WITH H D MAX-I-METER



H D Max-I-Meter clamped directly over transformer lead shown in use registering maximum load of a distribution transformer.

H D Max-I-Meter shown in closed position as used in service.

H D Max-I-Meter with clamp open ready for installation on transformer lead.

TAKE the guesswork out of distribution line transformer operation. Know your maximum load for a given period—a day—a week—a month. Simply clamp the H D Max-I-Meter over one of the transformer leads and let it hang there as long as you want the test to run.

The H D Max-I-Meter will accurately indicate the highest load for any period of 30 minutes or longer. The maximum pointer remains at the highest position reached by the indicating pointer as shown in the illustrations herewith. This accurate load indicator helps save operating dollars and enables you to know the loads your transformers are carrying.

The H D Max-I-Meter is light in weight, thoroughly weatherproof—can easily be installed over any transformer lead having a current capacity within the range of the meter. It requires no support other than the conductor about which it is clamped.

The H D Max-I-Meter is thoroughly dependable and accurate. The meter element is the well known Lincoln maximum demand meter.

The H D Max-I-Meter has rendered money saving service for one of the largest utility systems in the country for two years and is now made available to every utility.

Try one of these meters on your lines—its money-saving features will soon offset its low cost and earn its rightful position among your testing equipment. It more than pays for itself.

Write for details or order one for 10 days' trial.

ELECTRIC HD COMPANY

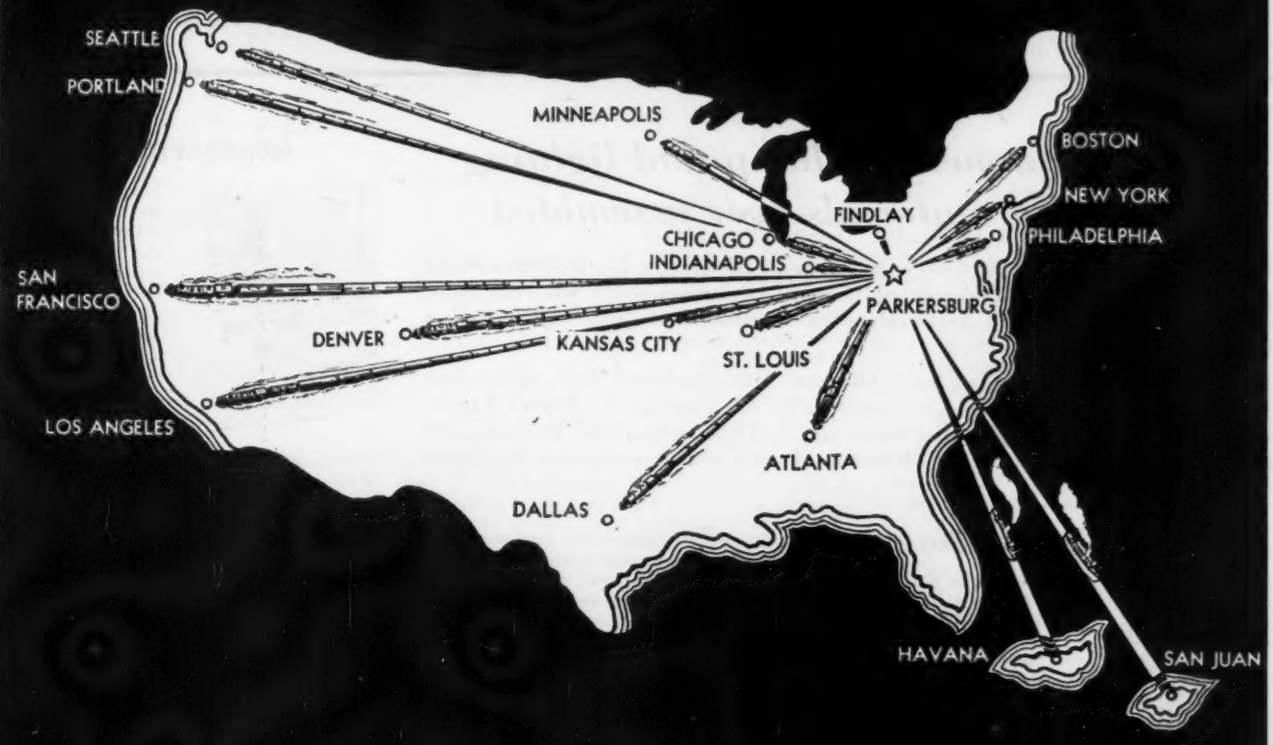
H D MAX-I-METER

Patent applied for.

H D ELECTRIC COMPANY

100 W. MONROE ST.
CHICAGO

Also sold by **Lincoln Meter Co. and Sangamo Electric Co.**



EMERGENCY SERVICE

During the recent flood emergency throughout the East and Middle West, many users of insulators and cutouts who bought from other sources found their regular supply houses under water or hemmed in by flooded transportation lines; so they turned to us without expectation of even normal service in this emergency.

Of course they got the same fast delivery as our regular customers. There was no need for discrimination in filling orders. We were ready—ready to do everything in our power to help restore service in a national emergency.

Wherever you are in these United States, you are never more than twenty-four hours away from a Porcelain Products Sales Office or Warehouse.

Specify Porcelain Products NOW and be sure!

Specify PORCELAIN PRODUCTS made by PORCELAIN PRODUCTS, INC. PP

PORCELAIN PRODUCTS INC. PARKERSBURG, W. VA. · U. S. A.

GENERAL ELECTRIC *presents*

Most comprehensive lamp and lighting plans and materials ever assembled

Prospects for a bigger year than ever before in the Better Light-Better Sight program grow brighter and brighter. General Electric is ready with the most comprehensive plans and materials ever assembled to help utilities plan local activities.

The G. E. utility program for 1936 and 1937 includes five objectives: 1—Advertising Dominance; 2—Lamp Sales Leadership; 3—Direct Lighting Sales; 4—Direct Merchandise Sales; and 5—Demonstrations. The program is keyed to the individual requirements of each utility executive in charge of these operations.

NATIONAL ADVERTISING

During the coming season General Electric will blanket wired homes with 550,000,000 insertions in 23 magazines and many newspapers, averaging 27 messages per wired home. These advertisements will feature MAZDA lamps at 15c and the G-E Dime lamps; Seeing and the Better Light-Better Sight story; and I.E.S. Better Sight lamps. In addition, trade advertising will continue in 45 leading trade publications.

EDITORIAL EDUCATION

Editors of leading publications have become aware of the news value of Better Light-Better Sight. All of the major women's publications have produced articles on lighting during the past year and many are planning such articles for this fall and winter. Approximately 3500 newspapers have also been kept informed of the program's progress.

SCHOOL LIGHTING PROJECT

One advertisement in the "Instructor" brought in over 4500 dimes from school teachers requesting a Grade School Project on light, prepared by the General Electric Company. The immediate response and complimentary comments on this has indicated the need for a new, more extensive project for 1936, which is being prepared.

RADIO CONTINUITIES

50 one-minute radio announcements and half a dozen radio sketches, featuring home lighting check-ups, I. E. S. Better Sight Lamps, and Better Light-Better Sight are available for local broadcasting purposes. Plans included tell how 15-minute and half-hour programs can be built from this material.

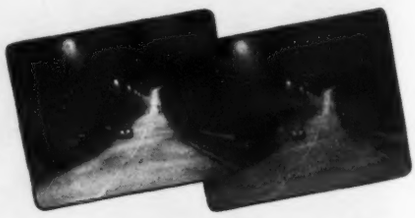
SUPPORTING MATERIAL

Because of the tremendous possibilities in the field of direct lighting sales, General Electric has prepared a wealth of supporting material. This includes: a series of four mailings on Seeing, I. E. S. Lamps, proper sized bulbs, and the low cost of light; a booklet, "Seeing Begins" telling the story of seeing in a different manner; and a new booklet on home lighting "Style Your Lighting, Too."

NEWSPAPER MATS

Eight different series of newspaper advertisements in mat form—more than 50 advertisements in all, ranging from single column by 7 inches to 3 columns by 10 inches—will be available to utilities. The subjects featured will include: Seeing, Home Service Advisors, Measured Light, I.E.S. Better Sight Lamps, Commercial Lighting, and MAZDA lamps.

MOVIES — SLIDE FILMS



A new talking movie film, "Energetic Eyes" and three new slide films will also be available. The slide films deal with home lighting, highway lighting, and store lighting. The movie and the slide films should find wide use before various organizations, employee's meetings, etc.

COMMERCIAL AND INDUSTRIAL PROGRAMS

Two entirely new series of direct mail pieces will be available for reaching the commercial lighting field. One set tells the story of light for selling and the other is a series of interesting letters presented in a new and novel way. A booklet "Light for Selling" is specially written for store owners.

For the industrial lighting field there will be direct mail series both by G-E and the manufacturers of lighting equipment, as well as a specific campaign on mercury vapor lighting.

GENERAL ELECTRIC

NEW FALL PROGRAM TO HELP UTILITIES PROMOTE *Better Light - Better Sight*

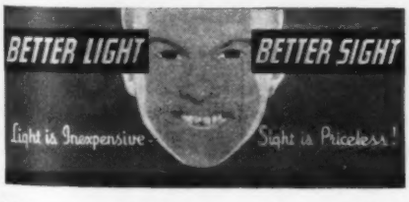
I. E. S. PROGRAM

In 1936 the I.E.S. Better Sight lamp cooperative activity will represent an expenditure of approximately $150,000 . . double that of 1935. An indication of progress made by the Better Light-Better Sight program is the fact that this fall there will be on the market dining-room and kitchen fixtures which have been accepted as meeting the I.E.S. specifications. The fall activity peaks in October—the second Birthday Anniversary of the I.E.S. lamp—when the bulk of the advertising is keyed to help the industry sell half a million more portable lamps than were sold in any one month previously. A complete portfolio will be available including a new booklet, "Eyesight Protection for Young and Old."

WINDOW DISPLAY SUGGESTION

Not only the utility's own windows and interiors but those of department and furniture stores, of dealers, eyesight specialists, paint stores and other contributing stores have been considered in the numerous suggestions for displays provided.

DISPLAY 24-SHEET POSTERS



Poster companies are making available several 24-Sheet posters in four colors featuring Better Light-Better Sight, Seeing, and I.E.S. lamps. Utilities may order these directly from the poster companies.

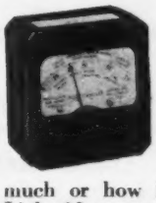
SALES TRAINING

The success of the G. E. Home Lighting Advisor's sales training brought requests from utilities for a similar training for commercial-industrial salesmen. G. E. again studied the demand, surveyed this phase of lighting activity and will have available by the middle of the summer the new G. E.—La Salle Commercial and Industrial Lighting Sales Training for all utility men, jobbers' lighting men, and manufacturers' salesmen. It should materially increase sales of light for selling, seeing, and production.

DEPARTMENT AND FURNITURE STORE PROGRAM

Recognizing the importance of department and furniture stores both as outlets for lighting merchandise and as "sellers of seeing," General Electric will make available for utilities a new booklet, "Developing Department Stores as Sellers of Seeing." This ties in directly with a new department store program of display and merchandising plans for selling lamp bulbs, portable lamps, and other lighting merchandise. Each store that cooperates by using this program becomes an extra selling force for your home lighting work.

LIGHT METERS



One of the greatest contributions to the entire Better Light-Better Sight program has been the development of the Light Meter. It does its part of the selling job by telling prospective buyers of better lighting, how much or how little light he now has. Light Meters are essential in any lighting selling program. They are available at $11.50 from the General Electric Company. Direct mail pieces including a new folder describing Light Meter uses are in preparation.

ADDITIONAL AIDS OFFERED BY G-E

In addition to the forementioned helps, General Electric makes available the following promotional aids:

Photographic Art Service . . . available for supplying photos applicable to "seeing" advertising . . . especially suitable for blow-ups to be used in windows and interiors, booklets, folders, etc.

Light Estimator . . . a new and inexpensive promotional device for making rough checks of home lighting.

New Type of Carton . . .for selling MAZDA lamps of various sizes and wattages.

Store Front Demonstrator . . . a special kit of material for lecturers to use before merchants' associations and similar groups.

School Lighting Booklet . . . "New Knowledge of Seeing in the Classroom" will tell the story of better lighting in schools and can be used with P.T.A. meetings, school boards, and the like.

A New Booklet . . . designed to tell the Better Light-Better Sight story to the prospective home owner.

Architectural Program . . . starting in the fall a series of articles will be published in which lighting from the architect's point of view will be discussed. These will be prepared by architects for architects, providing necessary lighting information and specifications in a usable form.

Miscellaneous Material . . . including Home Lighting Demonstration Kits, Room Index Boxes, Projected Light Meters, and other pieces of supporting advertising material.

WHAT YOU CAN DO ABOUT THIS PROGRAM

Every utility interested in selling light for seeing and lighting equipment will find these comprehensive plans and materials made available by General Electric very profitable. Your first step should be to get in touch with the General Electric lamp division serving you. Get the necessary plans and materials and lay out your own promotional Better Light-Better Sight program. The sooner you start, the greater your profits. Incandescent Lamp Dept. General Electric Co., Nela Park, Cleveland, Ohio.

GENERAL ELECTRIC

SWITCHBOARDS THAT YOU CAN INSTALL IN A JIFFY

It's just like getting them in a package

YOUR electric appliances, your breakfast food, your motor oil—they all come to you in a package. It has many advantages. It's the modern way.

Your next G-E switchboard will come to you, not in a carton to be sure, but all assembled, complete, ready to work—you simply bolt it down and connect the leads. Think what that saves, compared with the cost of installing a board not shipped completely assembled. Or compare it with the outmoded practice of building one's own boards.

Your next G-E board will be streamlined—all devices semiflush—a truly modern board. Think also of the quality and workmanship that only specialized engineering and factory facilities can provide. G-E switchboards have the extra value born of a vast experience, and built in by the world's largest factory devoted exclusively to switching equipment.

Ask our nearest office to quote on your requirements. General Electric, Schenectady, New York.

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GENERAL ELECTRIC

ELECTRICAL WORLD

MANAGEMENT · ENGINEERING · OPERATION · UTILIZATION

PUBLISHED EVERY SATURDAY

MAY 23, 1936

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Electrical Men Accept Challenge

THE ELECTRICAL INDUSTRY today is busy as never before changing its organization and practices to meet new conditions. This is a job in itself. But on top of this it must overcome the political plague that has accompanied the gaudy conglomeration of politics and economics that is called the New Deal.

Facing the facts as it finds them, the industry is going ahead effectively and courageously. It is making new records in output and in revenue. It is selling its service and products in unprecedented volume. It is capitalizing on the popular idea that the electrification of America will bring about the "more abundant life" conceived by the connoisseurs of quackery.

A dramatic speeding up is occurring. The industry is bearing down with all its talents to expand, to improve, to sell and to win public and customer favor.

Yet no industry in the world has done so much in so short a time. In fifty years it has poured $13,000,000,000 into light and power service facilities. It has invented, made and sold thousands of electrical products that now call for the generation of 100,000,000,000 kw.-hr. each year. It has established minimums in cost and magnitudes in operations beyond comparison. *All this was done under the initiative of private enterprise.*

So good was this job that the New Dealers, with their love for new snake medicine, seized upon the goal of the industry as a platform to stand upon.

They would complete the job of American electrification. As a first step in this program they tried to discredit and to destroy private utility enterprise. They admittedly are after government ownership of utilities.

At first they made headway. They got their yardsticks. They passed unfair and destructive legislation. They harried the industry day and night. They were jubilant bear-baiters.

But then things happened. The utilities, in self-defense, went to court and are

still in court. But also the public awakened to the forthcoming endless chain of taxation. Utility managements won the customer favor through their service. As a consequence the *wave of political persecution is now receding rapidly.* It is maintained largely by the bureaucrats established at the time of the crest. *The public is being fair to an industry that has done and is doing an outstanding job in making electricity universally available.*

These political and legal activities are on top of the business realities faced in the daily operations of the industry. *They serve to accelerate business-getting as one method to use for combating the destroyers.*

Especially in sales. To speed up sales is a major industry program. This is the road to contented customers and greater prosperity. The results already attained are astounding.

Complete unity of purpose prevails in the sales programs. Manufacturers, utilities, wholesalers and retailers are pulling together. They find that co-operation is necessary. *They find that the larger the volume of sales the lower the unit cost of selling.* They have, as yet, found no maximum limit to this principle.

Sales and service go together. Equipment must be kept at work as well as sold. Sales tie into public and customer relations. They are linked to rates and profits. They require executive support. That the industry has reorganized to carry out its sales program is attested by two facts: First, all past records are exceeded in the magnitude of sales made; second, local public and customer relations were never better than those existing in the industry today.

But the sales program by no means encompasses the scope of activities in the industry today. Executives refunded $1,000,000,000 of securities last year and continue at the same pace. The industry is busy with engineering work. It is remodeling its accounting practice. It is reorganizing its operations to humanize and to personalize its service to customers. *Departments that were for the convenience of management are remodeled for the convenience of customers.*

The industry is responding to the need for changes. It has built, bought and expanded in the past. It must sell, intensify, reorganize and devote more of its attention to service in the future.

The industry today is victorious in attitude and effective in action. *It is confident that it can show that it can give better service at less cost than any competing governmental agency.* More than this, it knows how to bring about the greater electrification that the public desires. It is determined to do this. It accepts all the challenges set before it.

Executives Survey Business

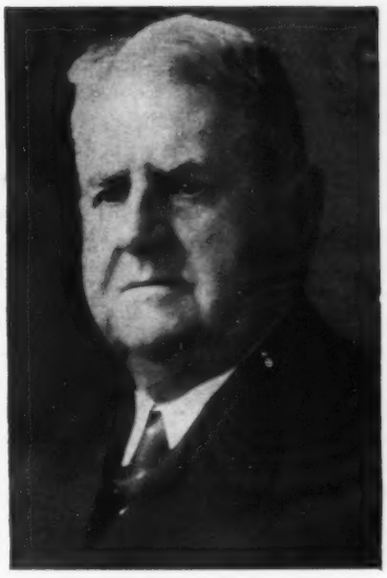
Conditions Good in All Sections — Output Growth Exceeds Revenue Increase—Building Revival Prevalent — Suggestions for Action

New Jersey Business Trend Upward

By THOMAS N. McCARTER
President Public Service Electric & Gas Company
President Edison Electric Institute

Business conditions in New Jersey have shown some improvement during the recent past and there is reason to believe that the trend will continue to be upward. For this belief there are various reasons. New Jersey's advantageous location, geographically speaking, offers many attractions to the industrialist. Its proximity to the seaboard and its transportation facilities —rail, water, highway and air—afford unusual conveniences for the handling of raw materials and finished products; its labor market—both skilled and unskilled—is ample to meet any demands, and low-cost electric power is available in practically unlimited volume.

These factors have played an important part in the development of New Jersey along industrial lines and, fortunately for the state and its people, this development has been of a highly diversified character. No two or three or half a dozen large industries predominate, as in some other areas; not that New Jersey does not have many outstanding enterprises of national and



Thomas N. McCarter

even international repute, but its industrial strength lies in the infinite variety of its products.

Silks and ships, textiles and toys, matches and machinery, pottery and platinum, needles and noodles, candies and copper and, literally, thousands of other commodities are manufactured, processed and fabricated in its workshops and factories. It is this very diversification of products that has helped New Jersey to maintain a higher degree of industrial activity during the period of depression than was the lot of some of the other states.

While it is not my intention to imply that the company for which I speak was not adversely affected by the economic conditions of the last few years, it is but fair to say that matters could conceivably have been worse. Under the circumstances it did well, all things considered. Present indications are that business will continue to progress. Demand for electrical energy for industrial, commercial and domestic uses is increasing. New industries are seeking locations in the state, more than fifty additional plants having been connected with our lines during 1935, with still others added since the beginning of the current year.

These gains have been made in the face of handicaps, not altogether economic in character, but, in a measure, artificially created, and *if our industry were relieved of the uncertainties and drawbacks fairly chargeable to existing political conditions we could look to the future with a feeling of real optimism.*

Philadelphia Area Progresses

By WILLIAM H. TAYLOR
President
Philadelphia Electric Company

Gains in sales of electric current, which began to grow impressively about twenty months ago, have been

At the request of "Electrical World" utility executives in many territories tell about general business conditions and the present outlook. They also report on the electrical business situation. These men are on the firing line and in a position to view business clearly. It is encouraging to note that nearly all report a favorable business situation and that this is reflected in electrical activities.

William H. Taylor

maintained at an encouraging rate. As public fear grows less absorbing in people's minds the impulse to spend money for something more than the absolute necessities of life makes itself felt in the electric industry. This tendency to broaden the use of our product has been and will continue to be fostered through the use of tried and proved selling methods for further extension of our business.

A sustained advance for so long a period as twenty months, however, calls for still more intensive efforts to consolidate the gains already made and to increase them. This is particularly true in the electric industry because of the necessity for increased sales to make up for the effects of successive rate reductions and greatly increased taxes.

The industry sold more electricity in the first three months of 1936 than in any other similar period in its history, yet it received less than in the last previous quarter year of record sales, which was in 1930. The lesson from this is plain. We must sell more and more of our product. We must forcefully promote sales of appliances to the end that consumption of current may grow in step with lower rates.

Public response to our efforts along these lines has been encouraging, giving ground for the hope that reasonable tranquillity in general business will bring us still further gains.

Most of what is being said here is applicable mainly to the uses of electricity in the home and in the smaller and medium-sized commercial establishments. It is in these fields that excellent results have been and are being achieved.

Well - considered, well - balanced methods of educational and sales promotion work, including advertising and intensive direct customer approach activities, have enabled us to keep pace with the general rise in business. We are intensifying these activities.

Business as a whole has done very well in our territory in the task of restoring normal conditions in employment and finance. Prophecy is out of the question for many reasons, yet it may be said with confidence that Philadelphia and eastern Pennsylvania look into the future with confidence that a great deal may be accomplished in further improvement in the next few years, provided there is a clearing up of those conditions which make for uncertainty in business.

Probably the most serious deterrent to expansion of industry on a broad scale is to be found in the endless effect of increased taxation—the great tax burden put upon the dollar in its every step as the wage-earner starts it on its way through the retail store up to the wholesaler and manufacturer. Many of us have been inclined to take too narrow a view of the effects of high governmental levies.

But it is the endless chain effect that is most disturbing. Higher taxes on the dollar in its swing around the circle from wage-earner up to manufacturer and distributor and back again to the wage-earner work more of a hardship upon the heavier industries—manufacturing for new construction and other business expansions—than upon the lighter industries. It is to these heavier industries that we must look for greater sales of electric power if we are to maintain a well-balanced output.

Just at this moment the uncertainties over taxation, national, state and local, are causing business men to hesitate, and when business men hesitate the effect is felt almost instantly by the electric industry, which serves them all.

Looking these considerations squarely in the face, it seems most unwise to attempt to predict. Perhaps that is just as well, for the inability to look even into the nearby future presents a challenge to our ingenuity, our skill in planning and our energy in carrying on our work for betterment.

Summing up, it seems that the future prosperity of the electric industry calls for expert work and plenty of it.

James B. Black

San Francisco Reports Better but Uncertain

By JAMES B. BLACK
President
Pacific Gas & Electric Company

Business on the Pacific Coast may be described as better, but uncertain. On the side of recovery we have increased industrial production with added employment, improvement in retail trade and a better outlook for farm prices.

Two of the most helpful signs are continued increase in electric power output and in home building. Power output continues about 12 per cent above the same period last year and home building is active in all the principal cities. In San Francisco, which may be taken as an example of what is going on along the Coast, building permits for the first quarter were 27 per cent higher than for the same period last year. Customers of electric service have increased. So has the use of telephones.

The electric companies are aiding recovery by liberal extension policies and by reductions in rates wherever

possible. The Pacific Gas & Electric Company voluntarily reduced its electric rates 10 per cent on January 1. This reduction will save customers approximately $4,000,000 a year, which sum no doubt will flow into and stimulate other avenues of trade.

Operating expenses and interest charges have been materially reduced by the principal utilities. The savings effected have been passed on to the public or used to restore wage reductions made during the depression.

In a sentence: The recovery trend is upward, but is slowed down by forces that create doubt and uncertainty. There is an absence of full confidence in the future; it will, in my opinion, require the return of such confidence to bring about full recovery.

Georgia Business Increasing

By P. S. ARKWRIGHT
President Georgia Power Company

General business conditions in Georgia reflect steady improvement. Retail and wholesale trade is running 10 per cent ahead of last year. Cotton mill production is 25 per cent ahead of last year. General employment is somewhat higher in this region. The cotton crop is slightly larger than last year. All farm work is two or three weeks late, due to bad weather conditions.

Residential energy use is up 11 per cent, commercial 6 per cent and industrial 12 per cent. Merchandise sales record a gain of 14 per cent for the first three months. The outlook is bright except for the serious threat of government competition in the northwestern part of the state.

Fair Business in the Anthracite Region

By J. S. WISE, Jr.
President Pennsylvania Power & Light Company

In so far as the electric utility business is concerned in this immediate vicinity, I am glad to be able to advise that there has been a well-defined increase in the sale of electric energy. Just at this time kilowatt-hour sales are higher than they were during the darker part of the so-called depression period, and the general trend for the past eighteen months has been upward.

The larger groups of general business in this vicinity consist of anthracite coal production, steel, cement and textiles (mostly silk). The first three named, for the first quarter this year, are doing somewhat better volume than for the corresponding period last year. The textile industry, however, is not showing the improvement displayed by the other major businesses.

General retail volume is somewhat better than for the first quarter of 1935 and there has been some improvement in building.

Definite Upswing in New York

By FRANK W. SMITH
President Consolidated Edison Company of New York, Inc.

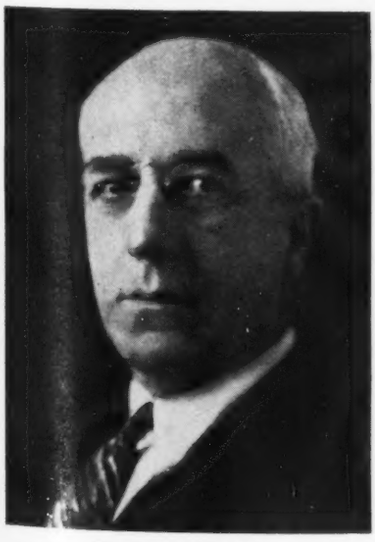
General business conditions are obviously reflected in their direct effect upon the use of our service. The periodic reports of the Edison Electric Institute are significant as to conditions over the country generally.

In our group of companies there has been reflected a similar increase in the use of service. While this, to some extent, undoubtedly is the result of the substantial reductions in rates that were made by these companies last August, we believe that a part of this increased use indicates an upswing in business activities in our area.

Skilled Labor Shortage in Hartford

By SAMUEL FERGUSON
Chairman of the Board Hartford Electric Light Company

Local industrial business is about the same as last fall, with the number of employees back to full normal force. Volume of orders would warrant greater activity, but acute shortage of skilled help prevents adding



P. S. Arkwright

J. S. Wise, Jr.

Frank W. Smith

Samuel Ferguson

G. C. Estill

A. Lieberman

men and managements are afraid to disturb labor by increasing hours over past code limits without setting precedent of prohibitive overtime rates.

Local building shows material increase over anything in the past five years, especially in residences built for sale by speculative contractors who find ready market for same.

Local utility business (electric) is good, showing material gains over last year. This is especially true of the domestic and commercial lines, rather than industrial.

Best in Florida History

By G. C. ESTILL

President and General Manager
Florida Power & Light Company

The past winter season has been the best in the history of our company. This general increase in business is true of the entire State of Florida. It is estimated that more than 2,000,000 persons visited the state during the past winter season. It would seem that Florida as a whole is the leader out of the late depression.

Real estate transfers are becoming more and more numerous, new subdivisions are being put on the market and property values have risen and are still rising. A national survey by Dun & Bradstreet ranks the city of Miami fifteenth among American cities in building for the first quarter of 1936, with a total of $2,338,512, representing a gain of 197.6 per cent over the same period in 1935. The area included in metropolitan Miami ranks sixth in the nation in the volume of its building for the quarter.

Postoffice receipts, bank clearings, customs receipts and figures on airship, train and boat travel all indicate a favorable upward trend. Plane travel in particular is becoming increasingly important, due in large part to Miami's strategic location as regards South America. During 1935 the city earned the distinction of being the nation's largest airport of entry for arrivals from foreign countries.

There seems to be little doubt that the lower East Coast of Florida in particular is entering upon a period of prosperity which bears some resemblance to the boom period of ten years ago. It is hoped and believed, however, that it will this time be founded upon real, rather than imaginary, values and will not end in a period of bankruptcy and depression such as concluded the early real estate rush, from which many Florida cities and numerous individuals are just now recovering.

During the first quarter of 1936 this company's electric output showed an appreciable increase over the same period in 1935. The use of major electric appliances is growing steadily and gratifyingly, as more and more homes are being equipped for complete electric service. In general, of course, as the outlook for the areas which this company serves becomes more encouraging, the outlook for our business itself is improved.

Business Up 25 per Cent in the Southwest

By A. LIEBERMAN

President
Southwestern Gas & Electric Company

At the end of April retail trade in our area is approximately 25 per cent better than at the same time last year. This is reflected in increased sale of shoes, dry goods and clothing. The banks report business from 15 to 25 per cent better. Small factories report business well ahead of last year. There is a small boom in the wholesale lumber business.

Our own business reflects these conditions. Our total kilowatt-hour sales for the first three months of the year are 11.35 per cent ahead of the same three months last year. By classifications the increases are as follows:

	Per Cent
Residential	17.11
Commercial lighting	18.75
Commercial power	12.55

These percentages in every case are increases above the first three months of 1935.

There has been some uncertainty in this territory regarding fruit crops be-

cause of the late freezes. The best information we can get now is that in spite of the freezes there will be marketed what is considered 50 per cent of the normal crop. In view of crop conditions for recent years I think it is correct to state that this 50 per cent actually represents what is about a normal crop.

Baltimore Growing Rapidly

By HERBERT A. WAGNER

President Consolidated Gas, Electric Light & Power Company of Baltimore

Statistics recently compiled by the Baltimore Association of Commerce show that the industrial improvement in Baltimore was greater last year than at any time since 1929 and that 49 important new manufacturing plants were located here in 1935. The total plant investment in new industries and in expansion of existing industries was $11,460,500 and this growth called for 3,584 additional workers.

It is interesting to note that 31 lines of industry were represented in the 49 new manufacturing plants which located here last year. This industrial diversity is of manifold advantage to our company in the supplying of power and fuel as well as beneficial to residential and commercial sales of electricity and gas through the stabilization of labor conditions, resulting in lessened unemployment and better wages.

Improvement in maritime trade kept pace during 1935 with industrial improvement in Baltimore; 3,059 vessels, the largest number since 1930, visited the port during the past year and disbursed approximately $16,000,000 locally for supplies. At the close of the year 52 steamship lines were operating out of Baltimore, as compared with 48 a year ago.

We find it unnecessary this year to make any additions to major equipment in our plants, as we have ample generating capacity for some time to come. Our budget for the year is practically limited to additions to our distribution system.

Like most of the utilities, we look for better sales for appliances, upon which, very largely, increased consumption depends. We are giving more attention to new-business development.

Home-Building Revival in Illinois

By BRITTON I. BUDD

President Public Service Company of Northern Illinois

The Public Service Company of Northern Illinois, serving a widespread residential, commercial, rural and industrial area, is, because of the nature of its territory, benefiting from a revival in home building and commercial activity. There seem, however, to be two factors worthy of note in considering these increases: First, that the residential building has been largely confined to the higher income brackets, and, second, the total volume of building as yet, while appreciable, has not been as great as predicted.

At this writing increased consumption of electric energy indicates that the merchants, manufacturers and farmers in our territory are showing a more optimistic attitude.

General Improvement in Northwest

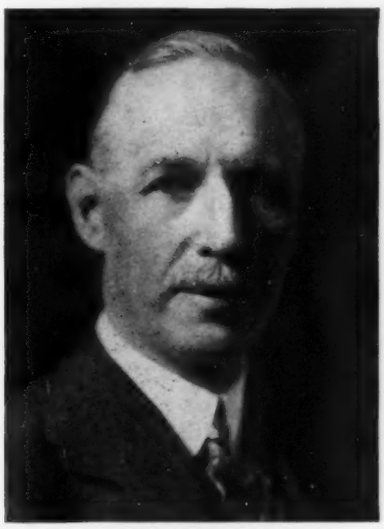
By R. F. PACK

President Northern States Power Company

It can safely be said that the electric business and business generally have improved in these central Northwest states—Wisconsin, Minnesota and the two Dakotas. The sale of electric energy has been running somewhat in excess of similar months in 1935, but various rate reductions made by many of the companies, plus some unavoidable increases in operating expenses, tend largely to offset what gains have been made in energy sold. Appliance sales for more than a year have been especially brisk. Some of the companies have had very gratifying results from appliance sales campaigns, particularly as to ranges, water heaters

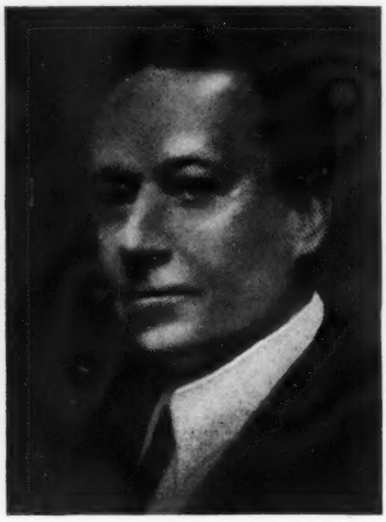
Herbert A. Wagner

Britton I. Budd



R. F. Pack

Joseph F. Porter



Frank M. Tait

L. A. Magraw

and refrigerators, which are the three major current-consuming devices.

Business, in general, was somewhat crippled throughout these states during the latter part of January and all of February. This was caused by the unprecedented cold spell, accompanied by frequent and heavy snows. Between the cold and snows, railroads and highways were blocked for many days at a time, with consequent curtailment of business. However, there was a quick business pick-up in March.

Farm income, which is of vital importance, is running ahead of last year, even though federal rental and benefit payments have ceased. Banking conditions continue in good shape. Deposits have gained considerably over 1935. Retail trade is running a little better than last year.

The outlook for agriculture, on the whole, is good. The soil has absorbed much of the moisture from the bountiful winter snows, but the winter held on so long that spring plowing and planting was delayed. Present conditions practically guarantee good pasture and hay crops. The outlook is for the biggest crop of this kind in many years, and the outlook for crops in general is as good as could be expected. Farm implement concerns report business good.

There has been a particularly welcome pick-up in the building industry. Total contracts signed promise almost twice as much building as last year, which was somewhat better than the year before.

Kansas City Makes Steady Gain

By JOSEPH F. PORTER

President
Kansas City Power & Light Company

General business in this section is somewhat improved, but we can hardly expect to attain a proper increase over the past slow years until we have a crop in this section of the country. When we are favored with a reasonable crop, I am inclined to believe that our business will show a large increase.

Our own particular business is showing a steady gain over previous years of substantially 5 to 8 per cent. Activities in Washington have materially interfered with the development of any expansions for electric utilities and therefore we have done little in that line. The outlook set forth is not especially promising until we have a better crop than we have had for some time.

Uncertainty in Dayton Area

By FRANK M. TAIT

President
Dayton Power & Light Company

General business conditions in southwestern Ohio show some improvement, but the many uncertainties now facing business and the purchasing public are causing considerable hesitancy and all of this is reflected in the public utility business of our territory, which is not as satisfactory as we think it otherwise might be.

Outlook Good in Illinois

By L. A. MAGRAW

President Central Illinois Public Service Company

This company serves approximately 20,000 square miles of territory, dependent almost entirely upon bituminous coal mining and agricultural pursuits. Of the 467 communities furnished with utility services, 416 have a population of less than 2,000.

General Business Situation—The twelve months ended March 31, 1936, showed the largest coal tonnage produced in recent years.

Fair crops on the average, at better prices, plus A.A.A. payments have aided considerably in replacing the farmer's depleted capital during last two years. Federal government aid in readjustment of loans also beneficial to debtors.

General business is quite spotty and fluctuates materially. Soundness of business base questioned by some. Unseasonable weather blamed by others. Some lines doing reasonably well, others slow and unsatisfactory.

Company Situation—Several substantial rate reductions and rate changes have been made during the past 2½ years. New and low unit-cost rate for full residential use has been made available.

Intensive load-building programs have been increasingly successful, resulting in greater use of company's existing facilities and requiring relatively small capital outlay.

Business Outlook—Anticipate no retrogression in general business during next several months. Bonus should stimulate business during summer. The relief problem still is serious.

Output Records in Southern California

By HARRY J. BAUER

President Southern California Edison Company, Ltd.

Based on our contacts with our consumers in our territory, general business conditions are considerably improved over last year. In so far as our own business is concerned, our gross income shows an increase of approximately 15 per cent over that period. This appears to be distributed over all classes of consumers. We expect to sell more kilowatt-hours this year than in any previous year, although the gross income will not necessarily be the greatest, due to substantial rate reductions.

Bright Outlook in Indianapolis

By H. T. PRITCHARD

President Indianapolis Power & Light Company

The general improvement in business activity in the Indianapolis area, which first became evident early in 1935 and continued throughout the year, has as yet given no indication of diminishing to an appreciable extent. Increased output of electricity for residential, commercial and industrial utilization has continued to reflect the trend of this improvement. Judging from present conditions, we believe that the business outlook generally for Indianapolis for the immediate future is considerably brighter than it has been for several years past.

Good Business in Portland

By FRANKLIN T. GRIFFITH

President Portland General Electric Company

General business conditions are steadily improving and we anticipate a continuation of the upward curve during this year. Energy consumption in our territory is increasing in nearly all kinds of uses and energy consumption will undoubtedly correspond to the general improvement in business conditions.

Oklahoma Analysis Encouraging

By J. F. OWENS

President Oklahoma Gas & Electric Company

The Oklahoma State Department of Labor reports covering the ten principal industries of the state (710 firms) show March, 1936, employment 6 per cent over March a year ago; payrolls 10 per cent over a year ago.

The University of Oklahoma Bureau of Business Research reports daily average (adjusted) retail sales in 57 leading stores of the state (department, clothing, furniture, dry goods, grocery, hardware and lumber) in February this year 12 per cent above the same month last year.

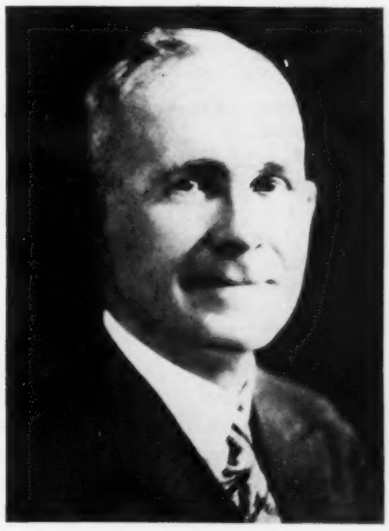
Average daily crude oil production in Oklahoma for February, 1936, was 6 per cent above February, 1935. The total production for the calendar year 1935 was 2 per cent above 1934.

United States Department of Agriculture reports that the total farm value of 64 principal 1935 crops was 21 per cent above 1934.

The same department reports that the total value of livestock on Oklahoma farms January 1, 1936, was 47 per cent above January 1, 1935.

Franklin T. Griffith

Harry T. Bauer



J. F. Owens

Thomas W. Martin

J. G. Holtzclaw

D. E. Karn

Although the foregoing statistical data all show definite improvement in business, enthusiasm over this recovery should be tempered with full recognition of some of the artificialities which have stimulated this improvement.

Electric business outlook

The company's gross revenues for the year 1935 were 4 per cent above 1934 and kilowatt-hour sales increased 10 per cent over the same period.

There are many unmistakable signs of business recovery—economic forces which are irresistible when released—thanks to the Supreme Court—but there are still many barriers to sound recovery. Until the present antagonism between government and business can be replaced with sympathetic co-operation we shall continue to flounder in artificial and unbalanced recovery measures.

Good Prospects in Alabama

By THOMAS W. MARTIN

President
Alabama Power Company

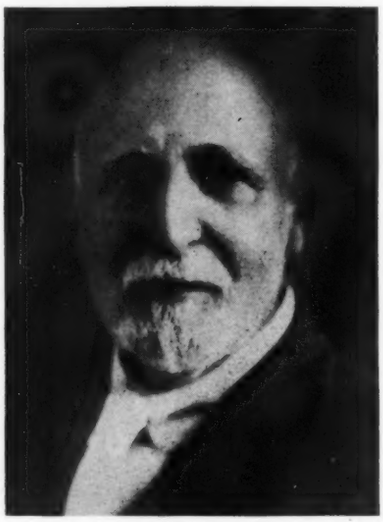
Our business so far this year has shown a very definite upturn over last year and has good prospects for continuing improvement. However, it is impossible for us to forecast the effect upon our business of the proposed federal loans and grants to municipalities to duplicate our existing systems or that of the subsidized T.V.A. operations in competing for our markets.

Detroit Better Than Seasonal

By ALEX DOW

President
The Detroit Edison Company

Business conditions and utility business outlook in this territory for the next few weeks are each good. There are exceptional combinations to account for conditions better than seasonal, but no one will predict conditions beyond these few weeks.



Alex Dow

Splendid Business in Virginia

By J. G. HOLTZCLAW

President
Virginia Electric & Power Company

General business conditions in tidewater Virginia and northeastern North Carolina are substantially better than a year ago. Building operations far exceed any one of the past five years. Manufacturing plants, including tobacco, paper and textiles, are running at a high rate of operation. Retail trade of the entire Fifth Federal Reserve District is substantially above last year and the electric output through April 30 was approximately 9 per cent over last year.

Michigan Business Very Good

By D. E. KARN

Vice-President Consumers Power Company

General business conditions continue very good throughout the territory we serve. Sales to industries are approaching peaks reached in December, 1935, and January, 1936. Present indications point to a continuation of present levels through May and the greater part of June. Domestic sales are improved.

"The Industry Today"

Electrical World Presents in the Form of Editorial Reports the Results of an Exhaustive Survey of Present Conditions

Much Encouragement in Outlook

New conditions face the industry. New developments in policies and practices have occurred to meet them. The industry is not static. It continually perfects its equipment and its operations.

Vital aspects of industry activity are discussed in the editorial committee reports presented in the following pages. These reports give the high spots as viewed by the editors. They were written as the result of much study and after consultation with leading specialists in the industry. They give a brief but competent survey of industry conditions.

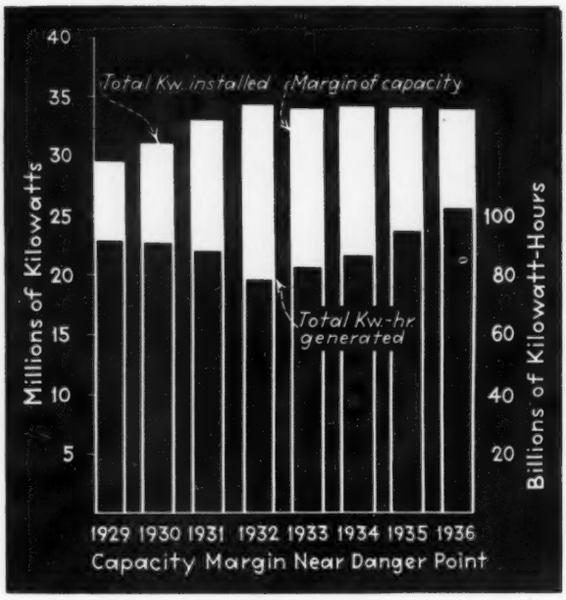
These reports indicate the need for industry committee work, for industry action and for planned and co-ordinated expansion. The conclusions are encouraging. They point the way to a large and more profitable business and to less expensive and better service.

Reports are presented on the following pages on Power Generation, Power Transmission, Substation Design and Practice, Distribution, Domestic and Rural Load Building, Commercial Load Building, Industrial Load Building, The Rate Situation, Legislation and the Courts.

Trends in Power Generation

PLANNING the power supply for a city, region, large industrial plant or the railroads is an economic problem of first magnitude. It involves the cost of generation, transmission, distribution and consumption. There are several alternative design arrangements in each division to add technical complexity. But the final decision must be based only upon the cost and the reliability of power at the places it is used.

Demand for power today lies largely in the thickly settled and industrial areas. This market is expanding. Electrical power is used at a greater rate than the growth in population and in the increase in the number of industrial plants, buildings or homes. Power use will increase enormously independently of any reduction in its cost—cheaper power, however, will speed the process and enlarge the market.



Relation of output and capacity on utility systems over a period of years

Lessons learned from practical experience show two basic principles to apply in the economic production of power. One is that power should be produced as closely as may be possible to the places it is used. The other is that any region has the cheapest and most reliable power if it is supplied from a group of properly located fuel or hydro stations or both that have electrical interconnections to increase reliability, to decrease reserve capacity and to use increment additions to capacity to best advantage, rather than from a single large steam or hydro station.

The economic distance for power transmission has gone down steadily in the past twenty years, until now it is about 100 miles. This fact, together with the increased reliability required in power service, makes uneconomical and unserviceable the use of superpower hydro or fuel plants located at great distances from the load. The conception of a few mammoth power stations connected by long, high-voltage transmission lines as the top grid for national power supply is erroneous. The facts more nearly dictate the use of a larger number of smaller stations located in densely populated areas, in industrial areas and in large cities. *The governing factor on size is the block of load to be supplied near each generating source* and that on reliability is a minimum use of transmission lines, switching stations, substations and other potential distance and equipment hazards that intervene between generation and use.

No equipment developments promise to change this fundamental economic conception. Whatever is in store in d.c. transmission, underground transmission and substations to lower these costs is offset by equally promising economies in fuel station equipment and design; in fact, the major savings appear to lie in this realm, thus still further condemning the superpower station and high-voltage grid idea.

Present developments in power generation, as dictated by the art and by costs, will take the form of

1. Adding capacity to existing fuel stations on utility systems by superposition.

2. Adding capacity to existing utility systems by the use of new unit-type fuel stations of relatively moderate size located as closely as possible to the loads.

3. Adding capacity by the use of joint utility-industrial plant stations whereby the steam and power demands of large industries are supplied by local plants that also serve and tie into the utility power supply.

4. Adding capacity by the use of highly efficient but small internal combustion engine units. These may be used in utility plants, in industrial plants, in commercial buildings and for special isolated power generation applications. As yet, however, the internal combustion engine unit is economical in limited size and therefore is useful largely for special applications.

5. Adding capacity by the use of hydro and combination hydro and fuel stations. Unfortunately, most of the undeveloped hydro sites are at great distance from load centers and thus there will be intensification rather than expansion in hydro generation.

6. Adding capacity by releasing transmission lines.

from "wattless" loading and by decreasing transmission losses.

7. Adding capacity by the use of more co-operation in the construction of plants between neighboring utility systems, thereby permitting construction to be staggered through the use of interconnections.

Steam Plant Design and Equipment

RECENTLY built steam stations operate at about 11,500 B.t.u. per net kilowatt-hour of output, with a total investment cost to get power on outgoing lines of about $100 per kilowatt. With the present fuel prices there is little justification for increasing the thermal efficiency of steam plants and attention is focussed on reducing investment costs and increasing the reliability.

Unit type plants with a single boiler-turbine-generator and auxiliaries to operate as independent generating sources may now be had to give an availability factor of about 95 per cent. This type of plant operates as a complete self-contained unit, it permits the maximum use of outdoor installation and gives a minimum space factor. With a better co-ordination of equipment and more compactness in design a still further reduction in space factor may be had. The trend is toward standard units of this type for both large and small capacities.

Boilers are available to give 1,000,000 lb. of steam per hour at 1,400 lb. pressure and 925 deg. temperature. They require a large space relative to other generating equipment, even though of high efficiency. Possibilities lie in new boiler designs of the "flash" type to reduce the size of boilers, but while several interesting new boilers have been developed, they are not available for the ratings required, nor do they give the reliability of the standard designs of boilers.

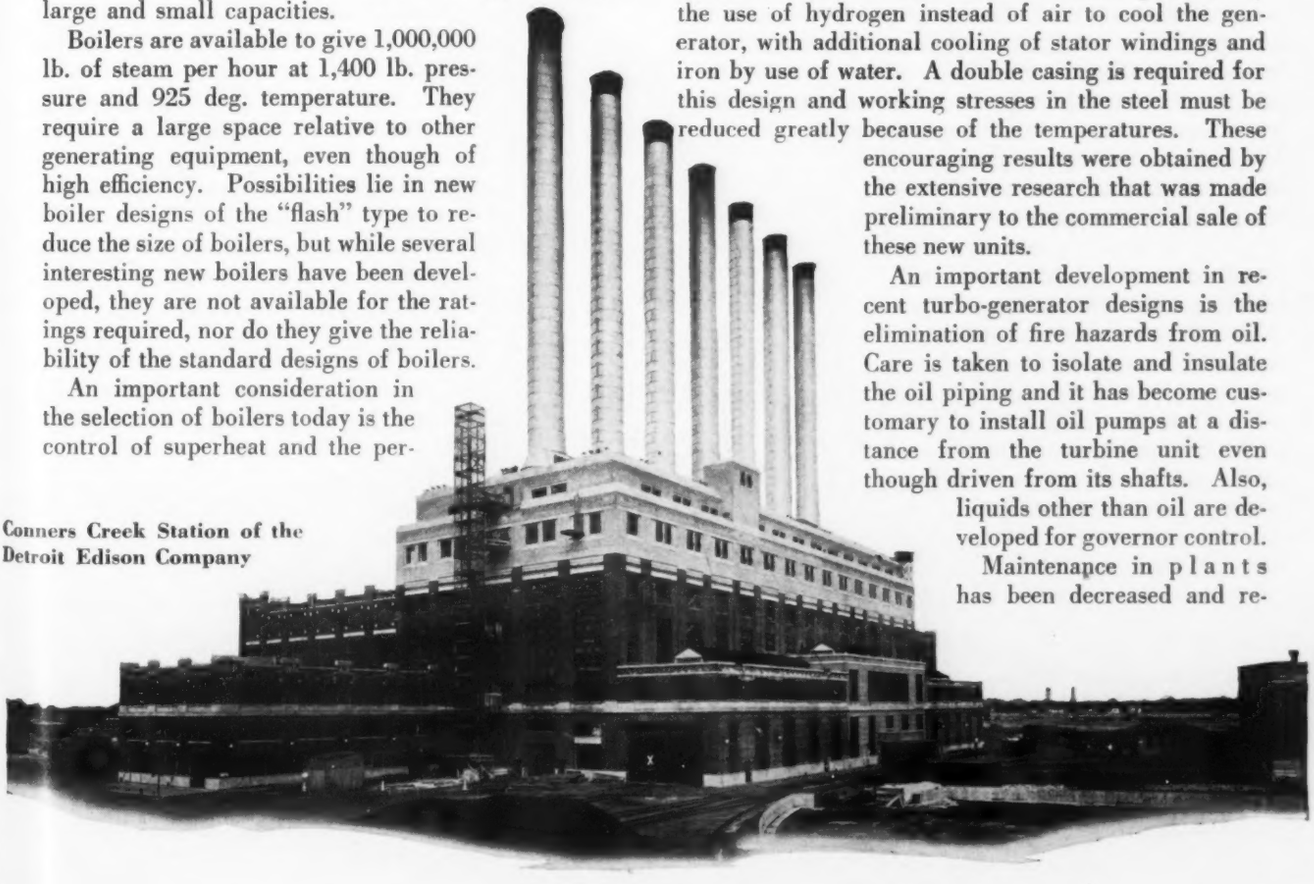
An important consideration in the selection of boilers today is the control of superheat and the performance of the boiler at both high and low ratings. If operation is to be always at a high rating the wet-bottom, high-capacity design can be used to advantage provided due consideration is given to feedwater, ash fusion temperature, availability and maintenance. Often investment cost reductions will be offset by increased maintenance costs and decreased availability. In many instances it is difficult to predict the future load conditions for a plant, and this point must be considered carefully. If operation is to be at both low and high ratings the dry bottom type of boiler often will be found more advantageous to use. Here again the fuel and operating conditions must be analyzed. The use of water walls and superheaters is universal in efficient plants, with a wide variation in design and equipment.

Coal is used in steam plants most frequently, but many burn gas or oil or a combination. When using coal both pulverized fuel firing and stokers are available in highly developed forms. On high-rated, wet-bottom boilers unit pulverized fuel firing is favored, but with the more normal large unit plants each type of firing has its advocates and advantages and disadvantages. Each plant necessitates a complete analysis of conditions to be met before a decision can be made.

A recent practice designed to reduce costs is the use of 3,600-r.p.m. turbo-generators. These are now available in ratings up to about 75,000 kw. for 925-deg., 1,300-lb. steam. These units are made possible by the use of hydrogen instead of air to cool the generator, with additional cooling of stator windings and iron by use of water. A double casing is required for this design and working stresses in the steel must be reduced greatly because of the temperatures. These encouraging results were obtained by the extensive research that was made preliminary to the commercial sale of these new units.

An important development in recent turbo-generator designs is the elimination of fire hazards from oil. Care is taken to isolate and insulate the oil piping and it has become customary to install oil pumps at a distance from the turbine unit even though driven from its shafts. Also, liquids other than oil are developed for governor control.

Maintenance in plants has been decreased and re-



Conners Creek Station of the Detroit Edison Company

liability increased. Better materials and designs in equipment, the greater use of controls and protective devices and the treatment of feedwater to get it pure and free from oxygen have aided the station operators greatly. Both the performance and the availability of new steam plants can be predicted with fair accuracy.

An important element to consider is the fact that the unit plant idea has been applied to both large and small plants. Especially notable are the use of outdoor construction, unit assembly and high-pressure, high-temperature plants in small utility and industrial installations. One may say that these almost portable steam plants are competitive with the very large unit plants. This fact favors decentralized and multiple generating sources for power supply, even while it introduces new questions of policy in power generation for utilities and industrials to consider.

The use of mercury-steam combination plant to any large extent depends upon further developments, particularly a better design of mercury boiler. The existing stations perform well and progress is encouraging, but major improvements must take place before this type of plant finds extensive use for power generation.

When to Use Superposition

A MAJORITY of steam power plants are from 15 to 25 years old. They operate at pressures up to 400 lb. The equipment is in good condition, but the economic performance is not satisfactory. These plants use from 20,000 to 30,000 B.t.u. per kilowatt-hour as compared to 11,500 to 14,000 for modern.

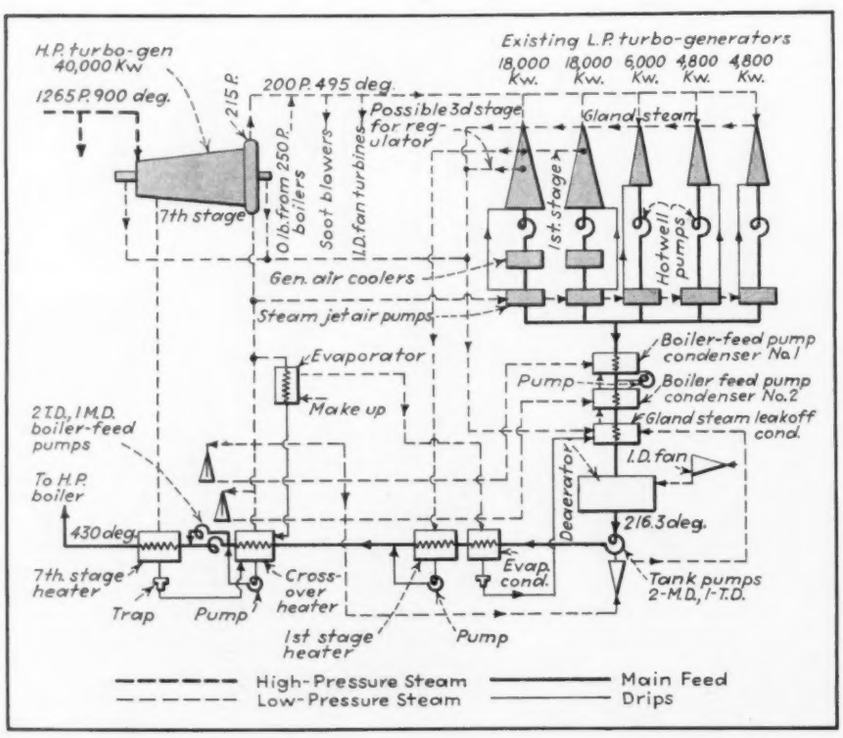
In these stations there is opportunity to install a superposed high-pressure, boiler-turbine unit to act in conjunction with the existing equipment. This superposition does three things: (1) It adds capacity to the system; (2) it makes economical the retention and use of existing plant equipment, and (3) it brings the over-all station performance up to an economic level.

Each case is specific and must be analyzed from the point of view of (1) the station itself, (2) power supply for the system as a whole. The true cost of power should be the final "delivered-to-load" cost.

A superposed plant is inherently complicated in design and operation. There are two pressure and two temperature levels. A wide variation can be had in design, in equipment and in heat balance arrangements to get maximum economy, reliable operation and flexibility. Sometimes the high-pressure and low-pressure plants are separated as much as possible. In other instances use is made of interconnections of all kinds between low- and high-pressure plants—usually to improve the heat balance and to get more flexibility. In this type of design the temperature at which low-pressure equipment is designed to operate is a major factor. The main point to be considered is the normal and emergency operation of the plant.

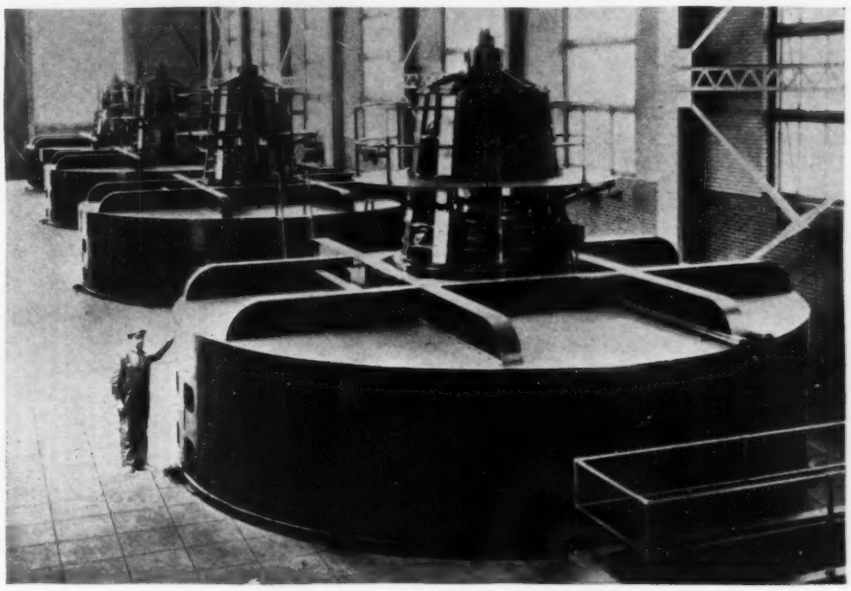
Usual ratios of high pressure to low pressure capacity in superposed plants are about 2 to 3, but higher ratios may be justified by use of steam-driven pumps and liberal bleeding. When operation is over a wide range the ash-fushion temperature is a governing factor in the choice of a dry-bottom or a wet-bottom boiler.

Fuel economy alone seldom if ever justifies superposition. There also must be a need for more capacity. Sometimes this can be had at other locations on the system to better advantage than superposed capacity placed in existing plants. Superposition, however, warrants serious consideration where a permanent station site exists near a growing load that needs more capacity to supply it and where the existing equipment operates at 400 lb. or lower pressure. Superposition permits of no generalization. It fits into modern power supply on the basis of each plant and each system when all power costs and power generation possibilities are evaluated on a "delivered-to-load" basis.



Schematic layout and heat flow diagram for the superposed Logan station of the American Gas & Electric Company

Place of Hydro and Diesel



Federal projects give impetus to hydro

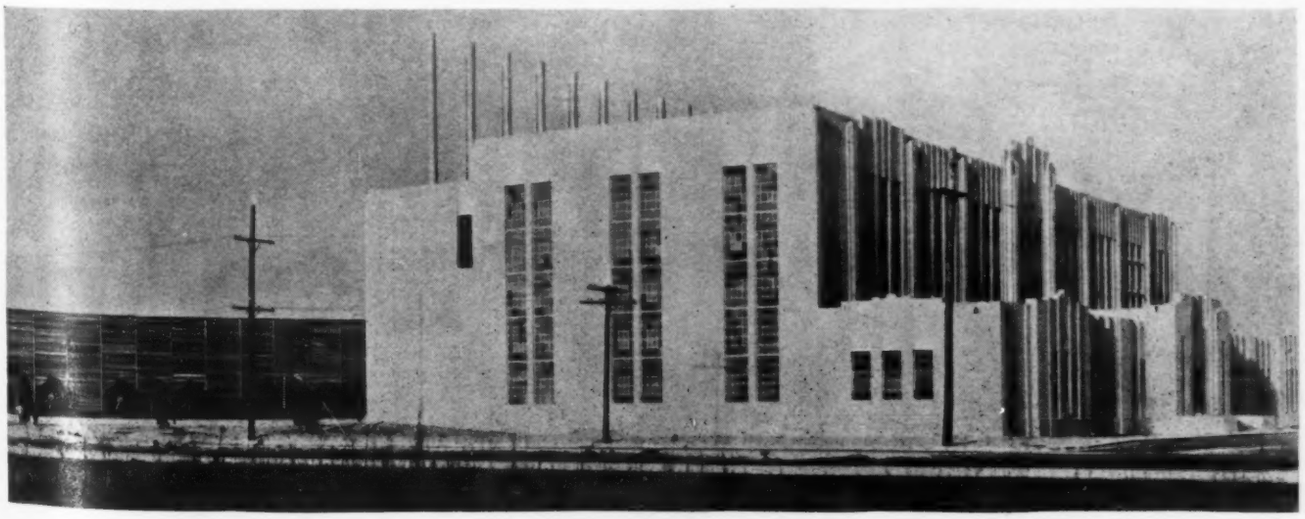
HYDRO plants attain an efficiency of about 90 per cent and afford little leeway for further gains in performance. The equipment and the design are well standardized and perfected and latest practices are represented in the recently completed government plants. Further use of hydro will come from the government projects now authorized and from more soil conservation, flood control and navigation projects contemplated by the government.

Outside construction and simplicity in layout and design are trends that help to reduce investment costs. Much of the new hydro capacity will produce surplus or dump power that will be difficult to absorb or sell unless integrated with a relatively large load area having fuel stations as the sources of primary power.

Outdoor construction in hydro stations is making little headway as against building the dam and station as one structure and the need for a crane overhead. Technical advances in hydro lie in the realm of draft tube design, use of variable gate openings and the introduction of quicker response governors. The practice is to make each generator an independent unit with its own transformer bank and auxiliaries.

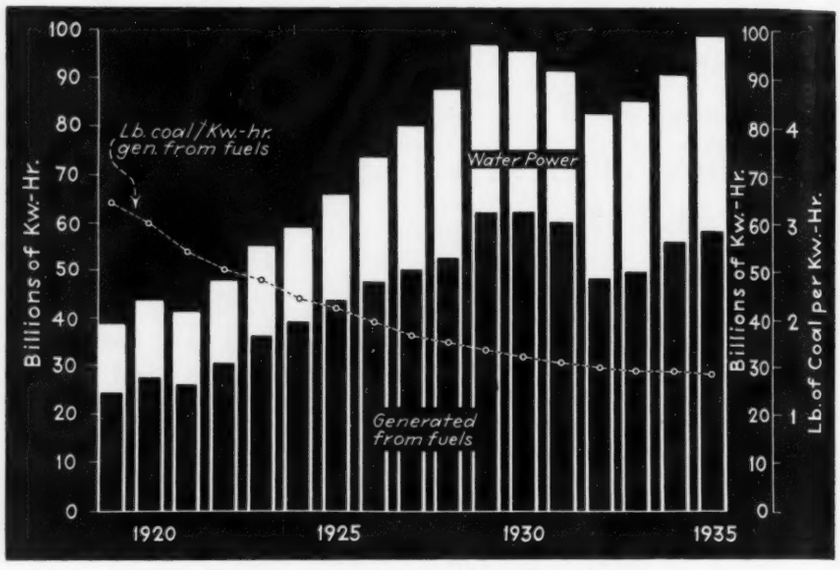
Diesel and internal combustion engine plants increase in use for small installations and for special applications such as are found in oil fields, locomotives and isolated mines and industrial plants. The majority of units sold for stationary power service are under 200 kw. in rating and the most recent development lies in making available these small Diesel engines for use.

Information on the performance of the large Diesel plant used for central station power in California has not been made available, so that a question mark still exists as to the use of large units and the performance of stations of large capacity. Continued progress is made in the materials used in the construction of internal combustion engine plants and the cost trend is downward. But as yet there is no indication that these engines will be a major factor in power generation.



Diesel plant at Vernon, Calif.

Costs Should Govern Generation



Energy generated in public utility plants

AN ANALYSIS of the available sources of power and of the technical and economical features of power supply indicates that steam plants must be counted upon to supply the greater part of the power needs that are now on the horizon because of business recovery. This is indicated by the recent orders placed and those in contemplation.

In the analysis of power economics, both as regards the size and the location of generating units, a new factor has been introduced that must receive serious consideration. This is the reliability of service element. Continuous service to any appreciable load is of paramount importance and systems must be planned on the basis of unit blocks of load served with a corresponding size of unit generating source or sources. In general, this principle, if applied, forces the adoption of relatively small-sized units in preference to very large units—say, 75,000 kw. as a maximum.

Fortunately the unit cost and the efficiency of these generating units compare favorably with those of large units when installed and the use of the relatively small units is advantageous in adding smaller units of capacity as needed as well as making for a minimum investment in reserves.

Another major item for study is the determination of the economic pressure and temperature to use. Because some daring engineers have adopted advanced limits is no reason for all to do so. There is reasonable assurance that the 600 to 800-lb. plant with 800 to 850-deg. temperature will prove most economical and satisfactory to operate for many power plant installations at this time. No generalization is possible, but serious consideration should be given to the selection of the pressure and temperature levels to be used in each instance.

Desire for high thermal performance has often led to an expensive and complicated station that cannot be justified. A serious study of fuel prices and operating requirements may often lead to a simple, low-investment-cost station that will give more satisfactory performance and better over-all economy than the high-efficiency plant. The true gage is cost and operating reliability under the operating conditions encountered during the normal life of the station.

Looking over the entire power generation situation, it may be said that equipment is splendid, the economics well understood and the principles to apply are agreed upon.

Photo by Charles Phelps Cushing

Norris Dam Ready For T.V.A.

Modern Transmission Substations

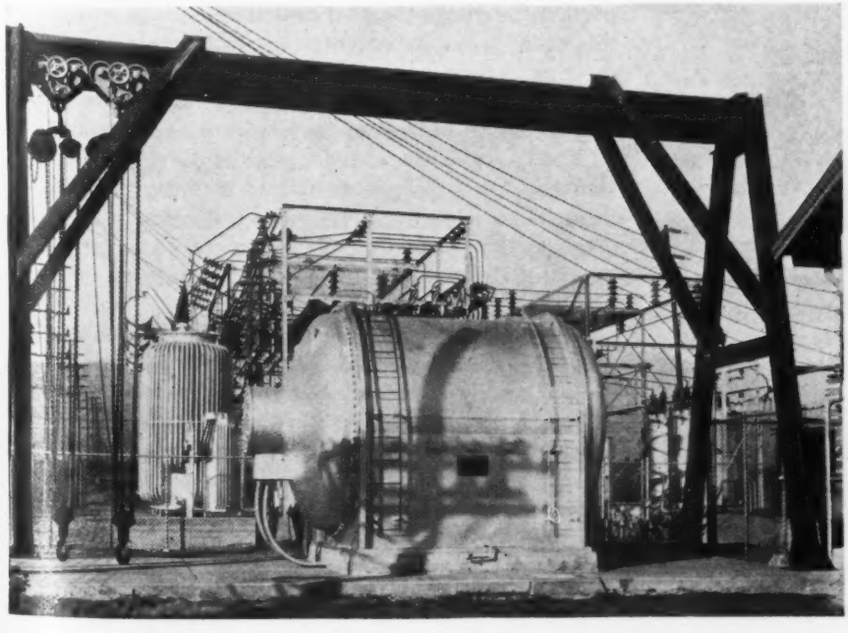
TRANSMISSION systems use substations to perform one or many functions. Voltage changes, sectionalization, circuit switching, tie-line connections, voltage regulation, synchronizing, control of wattless, metering—each or all of these things may be done. The endeavor is to reduce substation costs, simplify their operation and improve their reliability.

Cost reduction has been had by using large units, unit assemblies, metal-inclosed switchgear and miniature controls. Oil or compound to replace air for insulation reduces the space factor greatly. Miniature wiring and miniature control boards save investment in switchhouse, switchboards and control wiring and make equipment more accessible to the operators. Centralized repair and oil purification has reduced maintenance costs and improved performance. Full use of signal devices, supervisory controls, meters and relays make for safety. Many types of automatic protective and operating apparatus improve the operating reliability. Each item of equipment, such as transformer, breaker, relay and arrester, has been made more reliable and reduced in size for a given rating. Many of them have been assembled into compact units in the factory to save space and labor for installation. Many modern substations are practically outdoor, metal-inclosed, functional operating units and the trend is steadily in this direction.

On some properties it has become practice to install hydrogen-cooled synchronous condensers at substations, both indoor and outdoor types. As transmission networks grow, there is a growing tendency to put load control, phase-angle control and voltage regulation at substations. In some instances, it is convenient to install synchronizing devices at substations. Thus, in many ways, a transmission substation is becoming as important as a generating station in controlling energy conditions on a system. A balance must be had between the use of transmission substations and multiple-generating stations. At present economic and operating conditions point to fewer substations and more generating plants.

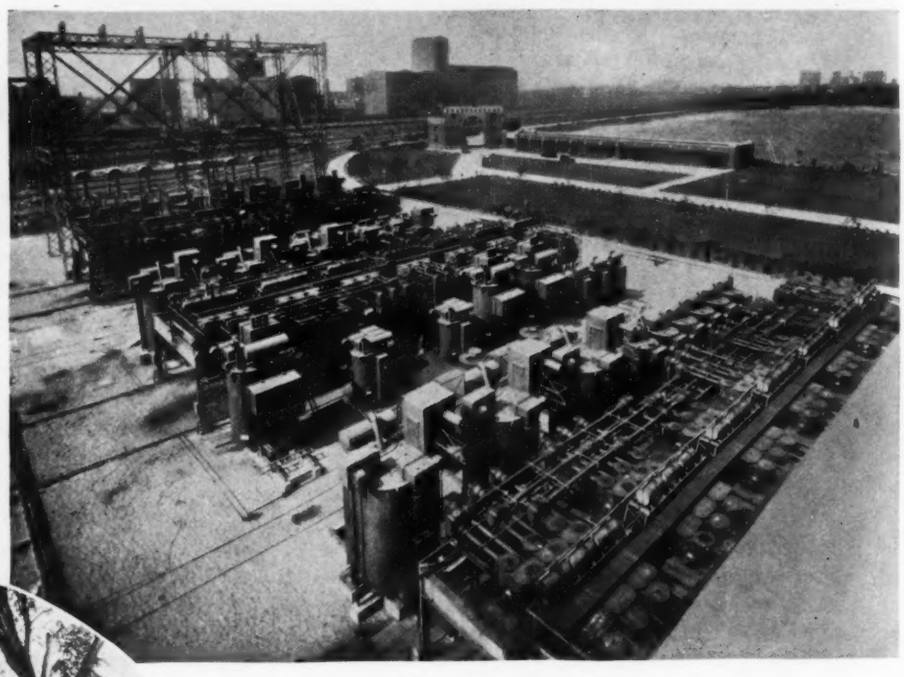
As systems grow transmission substations, although fewer in number, will become of increasing importance, especially those located at load centers. They usually have energy supply from more than one generating station and are key points for switching, for energy control and for rendering service. Under these conditions they must be designed with the idea in mind of serving blocks of load or circuits of such a size that the failure of any power supply line will not jeopardize service to the load. The capacity of substation units and lines are fixed by these continuous service requirements as well as by incremental investment costs.

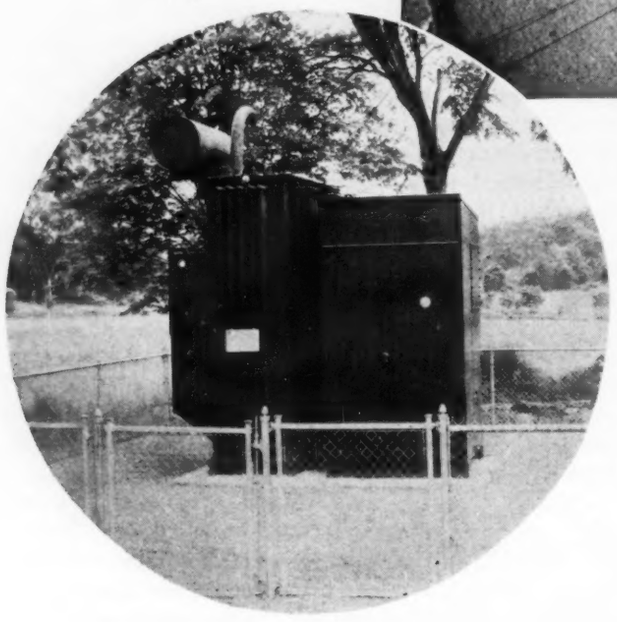
Equipment for substations has been improved greatly in efficiency and performance so that the availability of substations is high. Apparatus in some older substations can and should be modernized, but, on the whole, the higher voltage substations are giving exceedingly good performance. A major possibility for improvement at present lies in the reduction of cost of high-voltage metering and control equipment and more simplicity and unity in the connections and apparatus assembly. Further development of supervisory and automatic features will improve performance and is proceeding rapidly. Idle investment should be eliminated, voltage insulation levels should be selected carefully and quicker and better protection should be provided to improve high-voltage substations.



In a congested urban area the substation to supply local distribution is in a state of flux, brought about by several factors. in some cases distribution is being fed directly from generating sources—the network, synchronized-at-the-load principle. The

progressive abandonment of direct current in many cities makes it possible to reduce the number and complexity of substations. In network areas the unit substations are placed in underground vaults or on poles. For large industrial loads there is a growing tendency to use the subtransmission or the generator voltage as a direct power supply with substations on the local premises. In large cities having high office buildings substation compartments are placed on the premises. In some residential areas the overhead network replaces the radial type substation and pole-mounted transformers, switches, and regulators are used. Conditions are in a fluxing state.





Essentially an urban substation is a place to get a change in voltage for local distribution and to provide facilities for energy measurements, switching and control. A general tendency is to develop unit type substations that may be installed outdoors or metal-inclosed unit construction. These reduce the space factor when used inside of substation buildings or for outdoors. For safety, installations with built-in fire protection are favored. It is advantageous to use miniature controls and switchboards and a major application of automatic and supervisory apparatus. Non-attended and fully or semi-automatic substations give satisfactory service records and are being used to an increasing extent.

There is a tendency to eliminate urban distribution substations. If this is done it should be pointed out that the function must be transferred either to a transmission substation or to a generating station. Substation elimination is a question of cost and operating performance for each system—no generalization can be made. The trend is merely indicative of the endeavor to get simplicity and reliability and to eliminate all possible potential hazards and costs between generation and load. It also points to the growing tendency to supply local areas from generating stations and to the increased use of network distribution.

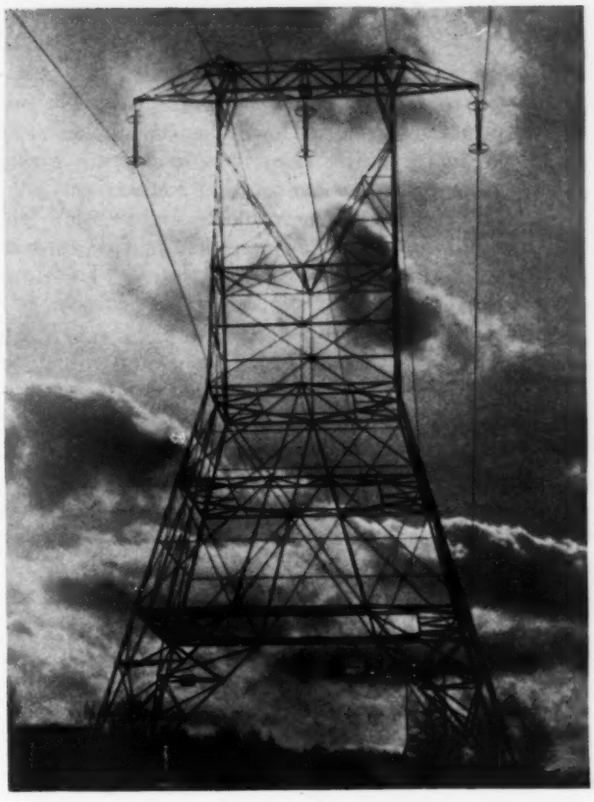
It should be noted that voltage regulation is an important function of a distribution substation and that this often is not as economically obtainable at loads or at generating or transmission substations as it is at distribution substations. Many engineers believe an over-all study of system performance and economics will not warrant the abandonment of distribution substations as a principle to follow in system development. This is particularly true if full consideration is given to the possibilities in lower costs and simpler operation inherent in small factory-built unit type designs.

As regional growth occurs and as an intensification of load occurs the general principle to follow is the use of multiple-generating stations or transmission substations with direct distribution to loads. But the territory served, the type of load and the system layout are major factors to consider in each case, and seldom will it be found economical or advantageous to eliminate the modern urban or rural type of distribution substation. They will be reduced in unit rating, but will amplify their functions in the future.

Trends in Power Transmission

THREE aspects of transmission are active: (1) Direct-current transmission; (2) underground transmission; (3) network transmission. The two first are experimental and developmental. They are of more technical than economic interest. The last involves the use of more transmission links on existing systems, further interconnections and local extensions. In addition it introduces new technical problems and the necessity for new equipment and controls.

Advances in the art of transmission lie in the ability to build lines that are nearly lightning-proof and the development of equipment that improves the performance and increases the rating of the lines. The reliability of transmission is now a measurable quantity that is determined largely by the investment put into the lines and in protective equipment.



Long-distance transmission

A two-circuit transmission line from Boulder to Los Angeles is to be energized this year. This represents the maximum in length and capacity and the latest developments in equipment and design. It is a peak achievement in alternating-current transmission.

This 270-mile line, rated at 287 kv., will deliver 240,000 kw. to the Los Angeles area. Official estimates of cost for the line only are $51,000 per mile and $57 per kilowatt. With the line, switching and terminal stations, but without generating costs, the cost values are $84,000 per mile and $95 per kilowatt.

These data prove that superpower lines introduce major costs in power supply. Even in this area, where right-of-way is inexpensive, the cost of this high-voltage line is larger than that of an intermediate voltage line per unit of capacity. The unit investment cost of transmitting this power is equal to the unit costs of low-voltage generating stations at the loads. Distance is a major economic handicap to power supply.

Technical advances in long-distance transmission are remarkable. There is no engineering handicap to the transmission of alternating-current power to any distance. The bugbear of lightning can be eliminated. Breakers that are fast in operation and of large capacity are available. Transformers, relays, insulators and other apparatus are highly satisfactory. Engineers know how to build a line to a given specification to give a predetermined performance. But there is an if, and a big one. Costs must be considered. And costs forcibly favor the generation of power where it is to be used.

Direct-current transmission is now much discussed for long distances. Use is made of vacuum tubes, mercury rectifiers and even static generators to develop high-voltage direct current. But while encouraging progress is being made, there is nothing yet available to change the present economic status of long-distance transmission. Direct current, at present, can be used only for relatively low voltages and in limited capacities. There is no evidence at this time to prove that it will reduce costs or improve performance when applied to high-voltage superpower lines.

Considerable cost reduction possibilities in transmission are said to lie in the endeavor to go underground with high-voltage alternating or direct current. What might be called underground pipe lines filled with oil or gas under pressure have been developed, and these promise a reduction in right-of-way cost and in line material cost. Improved operation also is expected because exposure hazards are eliminated. But even these new developments do not promise to change the present high cost of long-distance transmission appreciably.

It may be that economic and service conditions will be made more favorable to long-distance transmission in the future, but at present, despite splendid technical advances, the economics of power supply as well as operating features usually limit the consideration of transmission to a distance of about 100 miles or

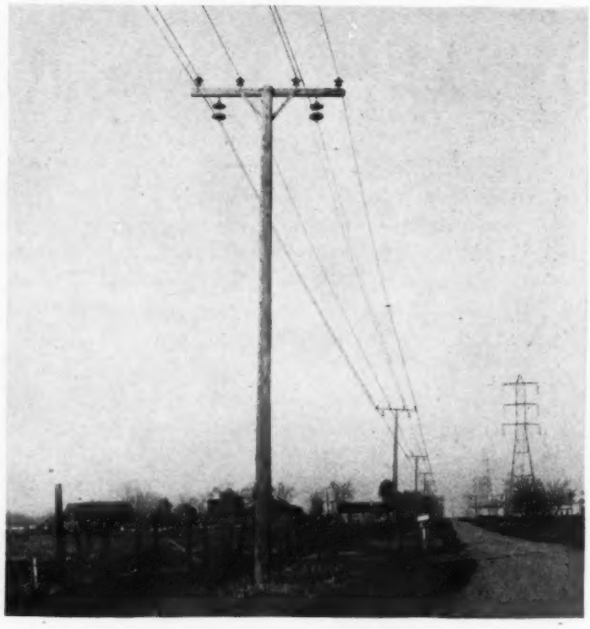
less. And the trend is still in the direction of reducing this distance instead of increasing it. This is a fact that seems to be little known.

Network Transmission Development

IN AN areal development of power supply transmission rapidly grows into network systems at two or more voltage levels. The higher voltage level is applied to major power lines from generating plants to load centers, between generating stations and substations, between load centers and to supply a few isolated large industrial customers. Most of these lines are in the 66- to 132-kv. voltage level. They are usually overhead lines of steel tower construction, but recently wood-pole and underground cable construction are frequently used. The lower level of voltage is used for transmission lines from local stations to substations, between substations, between local generating stations and to serve some large loads in congested areas. These lines may be overhead or underground with both steel and wood used on the overhead. This type of subtransmission system is found economical and convenient in developing both a local, city and a regional power supply.

On the main transmission system the goals sought are a minimum investment and maximum operating reliability. It is economical to use one circuit instead of two for a given supply if this will give the same service. It is desirable to have all lines lightning-proof and continuous in service availability. It is desirable to have all lines loaded. It is economical to have lines of standard design. If all these things are had in a given line or link the investment costs mount rapidly. The practical answer is usually a compromise between cost and performance.

Fast breakers and accurate relays are improvements that aid transmission greatly—they limit outage time to the order of 3 cycles. Use of improved arresters, counterpoises, shield wires and expulsion fuses make transmission lines lightning-proof at a certain increased cost. Co-ordination of insulation values enables outages to be predetermined, to be located and to be handled quickly and safely. Underground cable of several types can be used for key links to reduce exposure hazards. Apparatus and design are highly satisfactory for this range of transmission. But the growth of these transmission links on a system and the development of multiple generating sources introduce new problems for engineers and operators. A network of lines must be handled on a system basis. Lines are of different length and rating and are subject to variable loads, as are the stations. There should be control of load, of voltage and of phase angle on many of these lines. In addition there must be control of steady state and transient stability on each line and on the system. These things necessitate the use of new



and special equipment and well-planned operation. Often these higher voltage transmission networks have a loading that may be made up largely of wattless. The system capacity to deliver power may be limited by this fact. This condition points to more use of synchronous condensers as controllers to release wattless and to improve regulation. Synchronous condenser capacity up to 50 per cent of the system peak load is often justified. On the other hand, too much synchronous capacity on a system makes it "stiff" and difficult to hold together when sudden faults or load changes occur. A solution to these problems calls for good engineering design and a predetermined operating schedule for normal and emergency conditions.

Status of Interconnection

INTELLIGENT use of transmission interconnections necessitates a careful study of system economics and system operations under both normal and abnormal conditions. At best, interconnection lines are partly reserve and partly useful to reduce normal power costs. They necessitate an appreciable investment that should earn a return. They should be designed and installed to get maximum economy as well as maximum reserve and maximum reliability. Their use is justified most frequently only in emergencies and to stagger constructive schedules on adjacent systems.

Fundamental principles to apply to interconnections are:

1. To take care of emergencies on local systems.

2. To make possible local system economies by shutting down inefficient units during the daily, weekly and monthly load cycles, by better scheduling of loads between efficient and inefficient units and by better util-

ization of hydro plants and steam plants in a regional area.

3. To provide a means to take care of infrequent but major catastrophies over and above the reserves that can be justified on a local system.

The major problem is to justify interconnection under the two first principles so as to obtain the third, so to speak, as a by-product.

If interconnection links are made only between generating stations there is likely to be a fall-down in their reserve service when internal trouble occurs in the generating station because of a fault that causes it to drop its load. Also it is difficult to use all the links under normal operating conditions, because one or two stations are usually most economical and are favored in the production of energy. These facts must be considered in the system layout. It is also well to evaluate the relative costs and operating advantages of reserves in these lines as against putting them in local stations by use of added capacity.

If interconnections are made between load centers or substations instead of between generating stations trouble in a substation may make them ineffective to serve a local load. In general, however, if the transmission links go to load centers they may be loaded to better advantage in normal system operation and are more readily applied to serve loads in troubled areas. On the other hand, synchronizing and control of voltage and phase angle under trouble conditions are more difficult with this practice, and usually more complexity in equipment and increased costs in installation are involved. Each system is a particular problem for study. Good engineering is required if full value is had from interconnection.

In the same category lies the contractual and operating arrangements for the use of interconnections between foreign systems. Several satisfactory contract forms are now available and operations can be handled satisfactorily under normal conditions. An emergency or major trouble is the critical test of an interconnection as well as that of an operating system. The contracts and the operating schedules should provide fully for this condition. Responsibility must be centered as well as authority to act immediately. This is the time that interconnections should pay dividends by giving service. Under normal operations they are of doubtful economic value in many instances.

In a region with major transmission lines and many generating stations there is usually at least one subtransmission system. This has become of greater importance since loads have grown and since continuity of service has become paramount. A positive trend in accord with the economics of power supply is to supply large loads at subtransmission voltage directly from generating plants or substations. Most of these systems form a network coverage of a territory. In some cases there may be direct interconnections between subtransmission, the main transmission and the low-voltage distribution by use of intervening transformers, but this practice introduces hazards in isolating troubles.

If this kind of interconnection is practiced operation becomes difficult in time of trouble unless provision is made for sectionalization and isolation. As a general rule any subtransmission links that have a fault should be quickly disconnected in time of trouble. Fast breakers and relays should be used. In many cases reclosure breakers are assets to use freely. The point is that the development of a subtransmission system should fit into the complete system engineering design and operating plan. It adds to operating complexity in times of major trouble, but it is warranted by the economics of power supply and improves service when troubles occur.

System plan for transmission

Development of power for an area should be studied from the point of view of using transmission only as an agency to get power from generators to loads under normal and emergency conditions. The inevitable trend is toward network types of transmission with a multiplicity of lines and substations. Loadings, voltage regulation and performance when trouble arises are the critical operating elements. The investment cost in the development of the system power supply is the major design element after service standards are determined. Equipment is highly developed so that the major engineering problem is one of developing an economical and sound system plan whose assembly and operation under the variable conditions to be expected in a power area will be satisfactory. Simplicity, the fewest possible voltage levels, the minimum number of ratings for lines and substations and a high degree of precision in fault isolation are guiding principles to follow. A critical study should be made as to the amount and location of the reserves and their division between generating plants, transmission lines and substations.

Trends in Power Distribution

CONTROVERSY and misunderstandings make power distribution systems a center of interest. They represent the major system investment, the major operating expense, the major sources of trouble and the maximum number of variables in design and apparatus.

No yardstick exists for defining where distribution begins and ends. It is an indivisible part of each power system, with so many variations between properties that generalizations are untrue and cost comparisons are not valid. Today the trend to improve service, as well as the present intensification of loading, is in a direction to increase the investment in distribution unless drastic action is taken. Larger loads and more continuous service require increased distribution capacity, better system design and improved equipment.

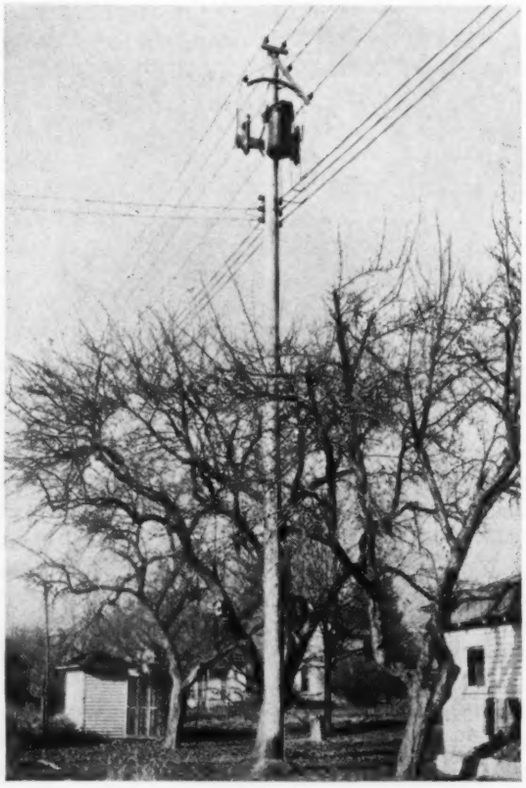
Cost reduction possibilities lie chiefly in the realm of assembly, of standardization and of eliminating accessory equipment. There appears to be little chance of reducing the cost of individual items used in distribution, such as poles, meters, switches, wires, cables, fuses, arresters, hardware, regulators and relays, except as an increase in volume or decrease in general prices make this possible. Many systems are rebuilding their distribution and more will do this in the future.

Distribution should be based on service continuity, flexibility, maximum loadings and good voltage regulation. These specifications must be met with a minimum investment and with minimum operating and maintenance expenses. If the principle is followed of going directly to loads from generating plants and transmission substations it is possible to use high-voltage distribution—the 11, 13 and 22-kv. types. This practice extends the economic distance of transmission and helps to eliminate distribution substations. But savings in this realm are often offset by the cost of high-voltage service taps and service continuity is less because of larger circuit loadings and longer exposure hazards. As a consequence at least two voltage levels are ordinarily used for general distribution.

Several types of distribution layout are used on power systems. Radial and network designs for both overhead and underground are common and there is often a compromise arrangement using radial substations with looped feeders. A network type of distribution in principle gives best performance from the standpoint of service, but cannot be justified for all systems or for an entire property because of cost. The trend, however, is in this direction, especially toward use of secondary banks. The wide differences in conditions on properties make it impossible to get universal standardization as to distribution design.

Overhead Distribution

There should be no distinction between rural and urban overhead distribution practice. The service requirements are the same and the contemplated load growth is of the same order of magnitude. Yet, at present, there is a distinction. Large poles, elaborate pole-top construction, short spans, reliable switching and relaying and the use of standard equipment and hardware for urban lines can be contrasted with the use of light poles, long spans, inexpensive switches and relays and special equipment and hardware for rural lines. It should be wise to use the good features of both practices to develop one standardized and simplified system. *In both types the principle to follow is to build distribution for an area and not a series of lines.*



Overhead distribution must be built to give continuous service. Cost reductions must come through standardization and simplification. There is a welter of systems, equipment and distribution standards that are conflicting, involve large costs and make for con-

plexity. Yet the essential differences are few when considered from either a cost or a service continuity standpoint. There needs to be more balance in design and expenditure. More money must be spent on those elements that produce service outages and less money on those parts that operate with excessive reserve capacity.

Competent opinion points to the layout of an overhead distribution system for an area containing many small loads that is simple, sightly and standardized. Small unit or factory-built substations should be used closely spaced so as to give, if possible, only one primary circuit on any street. This gives the effect of extending the high-voltage system and reducing the extent of the low-voltage system with consequent economies. Pole-top construction should be simplified, with provision for a minimum number of medium-voltage wires. Secondary racks should be used to carry three, four or possibly five wires, one of which will be the multi-grounded neutral. Secondaries should have few if any operating or protective gadgets, although the primaries will have reclosers, regulators and full protective equipment. These should be assembled into small factory-built unit installations for poles or substations.

Standard and possibly longer spans should be used with greater separation of bare primary wires and more effective tree protection. Primary wires should be well insulated, with a long life insulation, and should have tree guards or tree cable at exposure locations when located in tree areas. Bare primary wire should be used where no trees exist. Poles should be straight and well treated. The line construction must be made sightly so that the objections to overhead distribution on streets will be minimized. Full advantage should be taken of joint use and of present possibilities for street and highway lighting using new illuminants and low mounting heights with directed light distribution.

Secondaries from overhead systems must meet many different specifications. Rack construction is sightly and inexpensive and should be used more frequently. Often racks may be placed on buildings in city areas instead of upon poles. In many instances overhead or underground service cable can be used to advantage to serve relatively large loads and in locations where sightliness is paramount. New developments in these service cables are available. Special study and thought should be given to attachment and entrance facilities for secondaries.

Possibilities for a myriad of small refinements and improvements exist that will reduce overhead distribution investment and maintenance costs and improve service. The equipment and the practice are far from perfect. The field is open for invention, improvement and economy by building on the standard assembly basis and by utilizing the principle of mass production. If costs are to come down in the face of greatly increased loads and more stringent service requirements the engineers and the manufacturers must rise to the opportunities that exist.

Underground Distribution

UNDERGROUND service is hidden from sight and eliminates exposure hazards. But it is expensive. And it is relatively difficult to change to meeting shifting load conditions. While overhead exposure hazards are eliminated, other hazards are encountered in using oil in underground cables and vaults and in the frequently encountered proximity of corrosive or explosive gases.

Metropolitan urban areas with heavy load densities use the standard duct, vault and lead-cable construction. There is some use of underground cables for some services, for substitution connections, for street and highway lighting and for some rural installations in locations other than the congested parts of cities. New developments in equipment in ducts and cables are made to meet these new uses for underground.

Network underground cable systems have been installed in many large cities. Experience indicates splendid operation if this type of system is designed properly. The key to the design lies in fixing the block of load per unit network, the method of isolating or picking up each unit network and the selection of standard sizes for cables and transformers so that local network troubles will clear and increment additions can be made economically. The margin of reserve for the network must be based upon the reserves used clear back to generators.

Cable size is fixed by the ability of the cable to burn a fault clear. Transformer unit size is fixed by service and reserve requirements. Common practice is to use 250,000 circ.mil cable and transformers of 100, 300, 500 ratings for the general network. With a common neutral system care must be exercised to see that the neutral current is carried on a non-hazardous path when street neutral mains burn open during fault conditions.

Experience recently indicates the value of making all equipment in the underground system watertight and gastight. This includes potheads, transformers, cables and accessories. Cable improvements lie largely in the use of better lead sheaths and more careful methods of installation. Network protectors have been improved greatly in recent months. Underground networks can be counted upon to give good operation and splendid service. There are possibilities that a non-explosive, non-inflammable insulating medium will increase in use to replace oil in underground systems despite higher prices.

When to use network, radial or looped radial underground installations depends upon the already existing system, the load density and detail economic and operating analysis. On a cost basis only the investment in transformers and cables may not be warranted for many urban areas until the load density increases. On a service basis, however, many networks are justified.

A feature of underground distribution is the control of voltage, regulation and of loading. Cables and transformers must be worked within narrow temperature limits and the service to commercial buildings having diversified loads and elevators is often difficult to give without voltage fluctuations and poor voltage regulation. A rigid analysis of service voltage requirements and load variations is necessary to fix the rating of underground equipment and the location of apparatus.

Several types of duct for underground cables are available and each has advantages and disadvantages for the several kinds of underground installations encountered. Copper sheath, iron-armored and other types of cables are used for rural, street, lighting, park service and their residential area service to an increasing extent. But the bulk of underground is still installed by use of ducts and standard lead-sheathed cable.

Smaller and more closely spaced unit substations looking toward a network development are favored in underground distribution as in overhead. These substations are built on a unit assembly basis with metal-inclosed construction. In many cases they can be installed in underground vaults located in the streets or in the basements of buildings.

Progressive abandonment of underground direct-current distribution is now under way and the alternating-current network system is used instead. Great care must be exercised in laying out the new system because, without battery back-ups, an equally continuous service can be had only by providing a correspondingly increased margin of reserve in the rating and number of supply circuits to the underground system. There is no inherent reason for any difference in service if intelligent layouts are made for each property.

"The Industry Today"

Electrical World Presents a Survey of Selling Policies and Practices With an Interpretation of Trends and Possibilities in Load Building

Unprecedented Activity in Load Building

The country desires to have complete electrification as soon as possible. This desire is being met by the electrical industry. It is using every possible lever to speed up sales and load building. As a consequence the records of 1935 and 1936 are outstanding.

Industrial plants are modernizing through electrification. Many new factories are being built. Industrial power is coming back rapidly. Commercial business in lighting, air conditioning and motorization is booming. In the home and on the farm the industry is setting a pace that astonishes all. Selling is a major activity these days and points the way to prosperity.

In the industry today selling is a co-operative activity. Utility, wholesaler, manufacturer and retailer are playing ball together in each community. This team play creates an atmosphere of mutual confidence. More than this, it gets the business and meets the ever-growing competition for the purchaser's dollar.

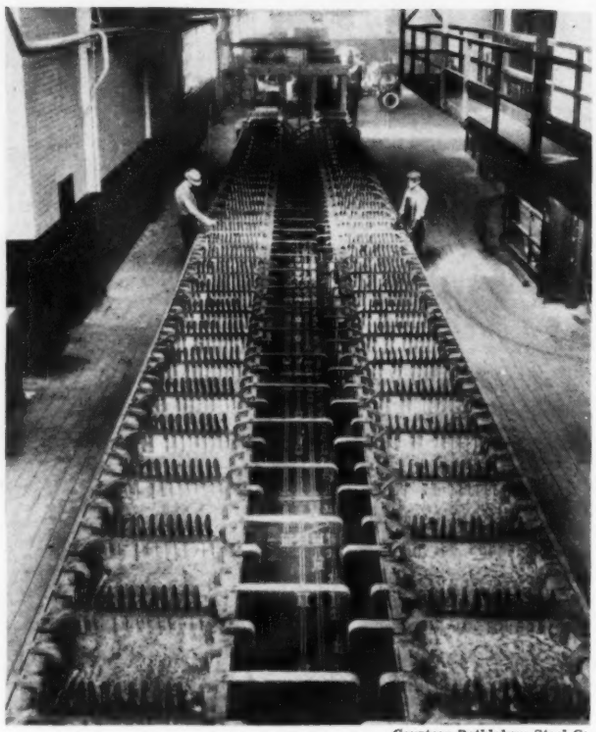
Reports are presented in the following pages on load building and sales as applied to industrial, commercial, domestic and rural classes of business. Highlights only can be given, with an interpretation of trends and policies. These reports are illustrative of the new-business wave that now sweeps the industry.

Industrial Load Building

WITH the possible exception of a few of the large industries which are blessed with an unusually alert and authoritative aggregation of electrical engineers, American industry in general will move electrically only so far and so fast as it is induced to move by pressure, appeal and education. Competition will provide the pressure. Economic gains will provide the appeal. The education will have to come primarily from those who have the power to sell. The job of education is being done, but there is evidence that it could be done in far more complete manner.

In order to stimulate the latent industrial load the utility industry should have a comprehensive power sales research set-up. It should study the current processes of each typical industry and lead the way in showing industrial engineers collectively in those industries how they can modify their technique for better economy and better volume by revolutionary substitution of electrical energy and control. It should blaze new trails by bridging the open gaps between unexploited physical principles and the industrial application.

Admittedly, this is being done in a limited way by the individual power salesman who is gifted with a broad perspective, but he has to work too often as a soloist, and not always with the unstinted support of his executives. Certain staffs have accomplished this sort of promotion on a collective basis. They are largely in the concentrated industrial areas. The job needs to be done for the whole country because industrial dispersion continues. Scattered utility divisions lack, under the new conditions in the industry, some of the direct guidance they have had from a centralized power sales staff. The substitute seems to be an industry coalition that will plan actively and openly for expansion of electrification of industry processes. To do this job effectively calls for coordinated effort on a national scale. It is costly if done solely as a purely local activity.



Courtesy Bethlehem Steel Co.

Zinc plating galvanizes steel wire

24 Bethanized wires have 40,000 amp. distributed to them by 36 contacts each as they move through 100-ft. tanks at "hot-dip" speeds

The impressive thing in industrial usage is that the gospel of electrification is taking hold. The momentum is there to cultivate. Whenever industry goes voluntarily after kilowatt-hours it does so in large lumps. In one recent instance the metallurgist hesitated to proceed for fear he could not get a sufficiently large generator of special characteristics to supply the planned amount of energy.

The reticence about large energy usage is being dissolved. In its place is coming a willingness to use electricity in large revolutionary blocks. Witness the following examples from, not so much the large concentrations of industry, as from small independent units, often far from the congested industrial areas:

1. Galvanized wire is being made by electroplating zinc to steel in Bethlehem Steel's "Bethanized" substitute for hot dip deposition. The wire is hustled through the plating baths as fast as through the former hot-dip tanks. Using 40,000 amp. made it possible. The homopolar generator had to be several times as big as ever before. The zinc ore is leached directly and the solution is the electrolyte.

2. A Southern kaolin plant set out to avoid all semblance of the melting, roasting, leaching and reduction that usually marks the chemical extraction of gross products. It gets a superior refined product directly from ore by purely electrostatic and electromagnetic means.

3. Electric roasting and electrostatic precipitation of rate metals from weak ores is another instance of making wholly electrical a process that was not. The electric load jumps markedly.

4. Application of electric heat (to the tune of 1,500 kw.) in conjunction with the platens of a hydraulic press and use of sheet glue makes finished plyboard in fifteen-minute cycles. No kiln drying, no clamping, no standing.

5. Sandpaper is being made sharper and more durable by shooting the grains electrostatically at the glued paper so the crystals will stand edgewise for greater cutting value.

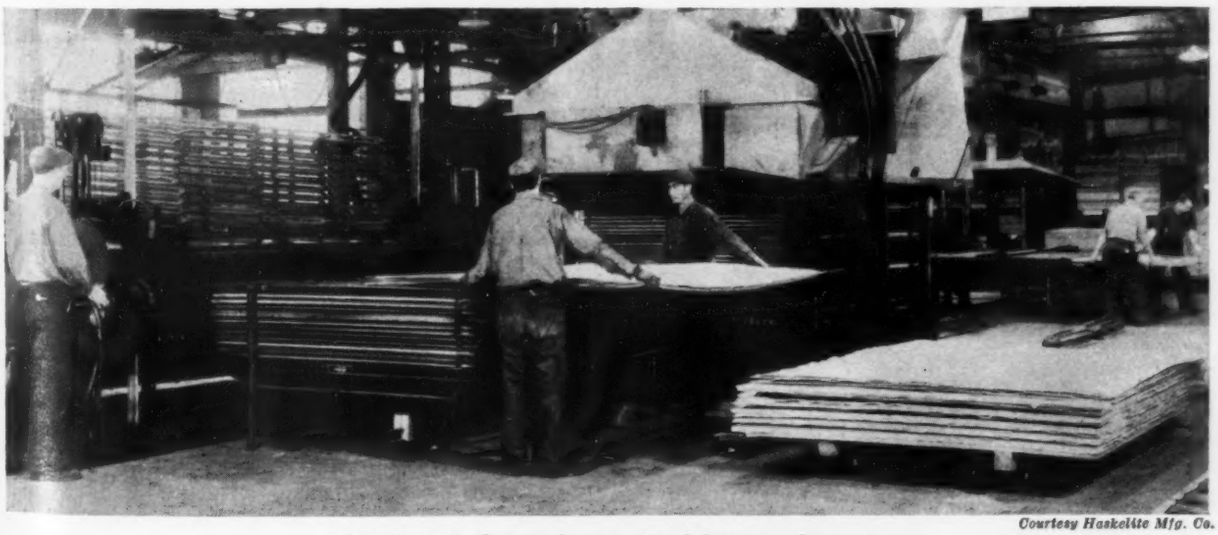
Power salesmen have had a hand in the encouragement of some developments like these. In a few cases they initiated them. If power selling is going to do more than merely take increments in consumption no bigger than the rise in the industrial activity index, more of this initiation will have to be the order of the day. What has already been done to grasp the loads that go with the wholesale movement of steel toward strip rolling, toward electric heat for production of industry's new alloys, toward substitution of welding for boiler riveting, toward more instrumentation and more use of electronic types of control are merely forerunners of what can be duplicated and excelled elsewhere. That is the story on large increments.

Courtesy General Electric Co.

Pyranol transformer, 900 kva., constitutes industrial department substation

Most of industry's electrification is a constituent part of broader modernization. This modernization wave has just begun. A few of the industries have decided that the way to resume is to resume, but not with the horse-and-buggy technique of the good old days. Mechanization is the order of the day. One workman turns out more, but gets more and consumes more. Controls are at his fingertips, but the control devices are less likely to be in his way. Subcenters for distribution and more wiring flexibility to facilitate machine rearrangements, more electrical meters to index production performance and more control of air temperature and condition are signboards that industry is electrically conscious.

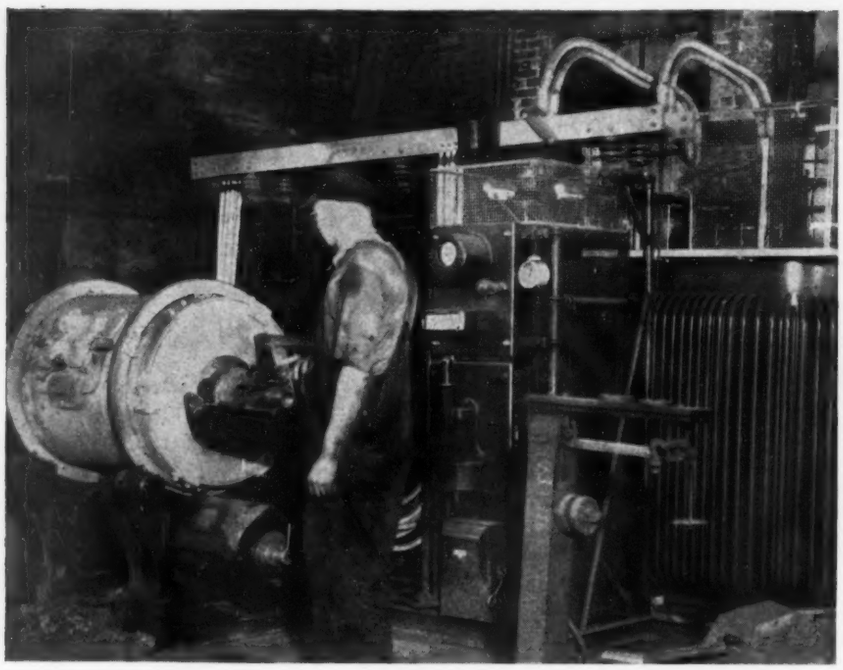
Fortunately the industrial power division of the utility business has always had competition to contend with, and that is why industrial power volume is as healthy as it is. Current emphasis on residential and rural and the prospective emphasis on commercial selling is traceable to the rise of new forms of competition there. All this signifies that the chiefs cannot avoid becoming selling-conscious. All one need do is demonstrate to them that 10,000 kw.-hr. more at 1 cent to one customer in one month can be as healthy and profitable a business as 100 more in a



Courtesy Haskelite Mfg. Co.

Interleaved electric heat units fabricate plywood

Stocked plywood (five sheets with synthetic resin glue between) has interspersed electric heaters that consume 125 kw.-hr. per thousand sq.ft. of panel in every fifteen-minute hydraulic press cycle; 500 kw. per press



350-lb electric melting furnace used in promotion of electric gray iron

year to 100 customers at 4 cents—and may be cheaper to secure and serve. Further, the latter might not be a good addition unless balanced economically with the former and with commercial and miscellaneous sales. The power business stands on four legs in equilibrium.

Being a quadruped means that it is probably a beast of burden—it carries man's loads and exists for man's benefit. Only in so far as it serves has it a right to existence and sustenance. In the justification of purchased industrial power it is imperative that stress be put on service value, in its intangible aspects especially—those which so often get overlooked in the overtures made by seductive competitors.

At least, sharpened competition has given the user to feel that he is now allowed a choice and that he is no longer an exploited victim of the power business. With that temper and with coaching, guidance and service factors available for his production operations he will naturally weigh these now more prominent features against a slimmer dollar differential.

Survey has shown that private plant competition and installation has not increased materially and still amounts to a small percentage of utility sales. This is true despite the fact that in the first two months of this year there were nine utility turbine orders placed and there were eighteen above the 1,000-kw. size for industrials. There were thirteen more of smaller sizes placed for industrial installation. Cannot this temporary spurt be turned toward beneficence for both industrials and utilities? The status raises more potently than ever the question of co-operative operation of industrial plants in conjunction with utility systems.

Out of the recent floods comes a sidelight on the virtue of renewed consideration of joint operation. There were many instances where utilities were able to rescue industrial plants whose power supply was interrupted by high water. In New England and New York State there were, conversely, certain industrial power plants which took over the burden of supplying local lighting and power load when utility facilities were flooded out of service. Corning (N. Y.) Glass Works carried the city load for 24 hours; Ingersoll-Rand (Painted Post, N. Y.), Nashua (N. H.) Manufacturing Company were other instances. American Optical Company and Ames Worsted in Southbridge, Mass., shared carrying the load of several towns in their vicinity. Back-up arrangements were persuasively back-up in these instances and advantageous to both parties.

These episodes point to the mutual advantage of co-ordinated operation of industrial generation with utility systems. Wherever an industrial plant can be justified because of the process and heating factors there is almost always the chance to extend the analysis to cover breakdown service by the utility on the one hand and to afford additional exchangeable capacity with the utility on the other hand. These plants are often where other industrial load is congregated and there is a demand for heat or process steam.

Competition also carries opportunity

In the competitive situation there is, however, the consoling alternative that the same arena of small and medium-sized industrials that presents the problem are the ones that also show great ingenuity in creating new products. They also show a wholesome tendency to make these products from the beginning by electrical processes that go into sizable energy magnitudes. The point here is that the power industry can, even in the face of competitive generation, be "choosy." But in order to be "choosy" intelligently it will have to pool its resources more effectively for survey and research.

The technique of inducing the industrial firm to look at the problem of power supply in all its ramification of outlay and expense, of dependence and independence, of forgetting power production and remembering product creation, of space, money and talent most advantageously applied—all this technique calls for more interchange of utility ideas at first hand. More meetings at closer intervals are the trend and the need at this point.

One major trend in power selling is the preparation

of a continuous industrial survey which affords the foundation for a selective program of sales effort. Continuous contact must be maintained with all industrial patrons if competitive power is not to make inroads. But mere prevention is no guarantee of a healthy constitution. The surveys can show where to apply talent, vigor and expense without frittering them away on less promising opportunities. This, by no means, results in neglect of the small and medium users. In fact, the stake of the power industry is with them rather than with the largest enterprises.

As long as competitive power exists in a territory, it constitutes a threat to success in power sales. It is fairly logical, therefore, that current surveys should be setting competitive industrial plants in prominent place for study and pressure. Lowered domestic rates can hardly be sustained unless the volume of output is held up by the commercial and industrial consumption. Every uneconomical competitive plant that is won over to power load is a benefit to all the rest of the consumers. Questions for the surveys:

What is the percentage saturation of load in each group of local industries? Which are in the best financial condition? Which are expanding and modernizing? Which have conditions most and least conducive to purchased power? Which have national associations that guide thinking on power use and application? Who has the "say" on power policy in each establishment? Can their present use be improved for better load factor and rate, for better quality of product, for extension of new products, for better light and atmosphere and safety of employees, for lowered insurance and taxes? Which can add plant cafeteria load in the commercial classification? Which ones can work up waste into useful goods? Which ones don't know how much their own power is costing them?

That is all a matter of finding out what the power sales engineer should know about his territory as an aggregate of potential purchasers. That kind of study is qualifying the utility staffs to be discreet pickers of prospects. After that there is still to be rendered the function of the consultant whose knowledge and advice is respected by the industrial client. To succeed in that capacity, the power salesman must know something about the characteristic processes and problems of his clients. Interest in power sales handbooks is reviving. Response to ELECTRICAL WORLD's Industrial Power Data sheets was immediate and widespread. With industry co-operation, this series will be continued.

This year has also seen the revival of the practice of circulating to power users small regular publications which give timely ideas about power application opportunities in terms of accomplishment and result in other industrial plants.

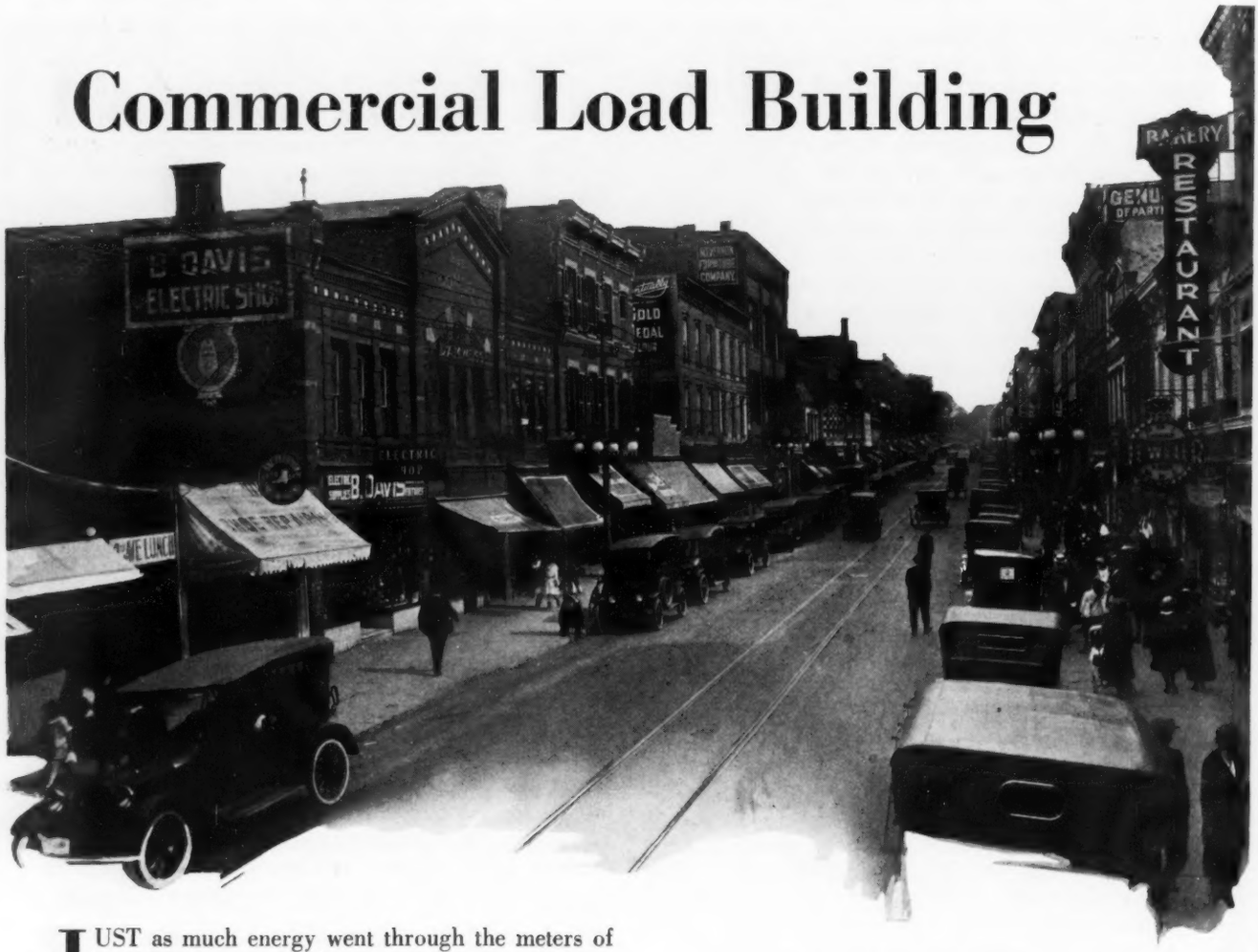
As a third service function to be performed for industrial power salesmen, there could well be a quicker medium for exchange of specific load and cost data in connection with current sales accomplishments. The time lag between power sales conferences and the limitations of their regional isolation can be overcome by a forum for tabloid presentation of new loads which would carry an immediate clue to opportunities in every salesman's area. ELECTRICAL WORLD is planning added space to render that forum available.

For the moment power selling is busied with a remolding of its technique and its departmental routines. This is involving a reallocation of assignments, a more thorough method of load surveying and an elaboration of records and reports. Not all the methods of the household sales staff can be adapted to the corps of industrial power salesmen, but some can be and are being adapted. Matters of specialization on heat, light, control, air conditioning as contrasted with horizontal single-man contact with industrial clients are being solved in various ways. The trend is, however, in the latter direction, with the specialist held in reserve for consultation and detailed analysis.

All these current activities conspire toward the end of persuading industry to use the surest power it can get at the lowest cost and greater profit. What is needed for the immediate future is a broad program to disclose the larger opportunities where this can be done to move the electrification of industry forward into new processes, new products and new industries.

Strip mill equipment control congregated in operating pulpit

Commercial Load Building



JUST as much energy went through the meters of 3,800,000 commercial customers during the past year as went through the meters of 19,900,000 domestic customers.

The way they used electric service enabled the commercial customers to earn a rate a cent and a quarter *under* the current low average rate for the nation's homes. So, while they used as much energy as did the homes, their bill for the year was $172,000,000 *under* the total for residential bills.

Spotlighted by those two statements, commercial business looks like good business; it is assuredly business worthy of unremitting attention.

Here are a few figures comparing 1935 results:

	Commercial (Retail)	Domestic (Excl. Farms)
Kw.-hr. sales (millions)	14,053	13,993
Revenue (millions)	$537	$709
Customers (millions)	3.8	19.9
Average rate (cents)	3¾	5

What are the possibilities of gaining more revenue from the commercial customer? Here's one way to gage the outlook: Commercial sales of 14,000,000,000 kw.-hr. in 1935 are just about what they were at their peak of six years ago. That is, the sales people finally have been able to sell as much commercial business per year as they were selling in 1930. The business was secured from almost the same number of commercial customers (the variation was within 4 per cent) as in 1930.

These two facts may permit the generalization that, on a national scale, the public utility companies may now accelerate the programs interrupted in 1931 and carry commercial sales to the new higher records now characteristic of domestic business.

The evidence presented shows that the boys from the sales department have been making calls up and down Main Street, doing a fine selling job and getting the load on the lines.

Air conditioning is, of course, a subject of extreme interest. Fortunately, the public is being well informed day by day upon the desirability of air conditioning, so that the roadway for future sales is being widened.

What is really going on in the air-conditioning sales field? Specifically, what rate of growth might a company use in its sales budget?

The latest reports from about 60 utility companies located in 29 states show that connected horsepower for air conditioning increased 17.3 per cent in 1934, 23.1 per cent in 1935. There are two figures worth jotting down.

During the past year, to continue the analysis a little further, residential installations led the field, numerically at least, 42 companies connecting 688 jobs, averaging 2 hp. each.

Three hundred and ten restaurant installations went on the lines of these 60 utilities last year, and 228 offices, 141 retail stores, 130 office buildings, 62 hotels, 59 theaters, 56 department stores, 37 beauty parlors, 20 furriers, 19 barber shops. Almost 1,000 other miscellaneous jobs became connected load, and among these the most numerous were saloons and bars, funeral parlors, florist shops and clubs.

Commercial lighting

Seventy-five foot-candles of light on working planes have been specified for the new Kress store at Fifth Avenue and 40th Street in New York. Here is an indication of what modern store and window lighting means to an alert merchandiser.

The revival of building is now gaining momentum in many sections of the country. It is opening the way for newer and more effective uses of light for both utility and beauty in the modern structures. The utility company is bending every effort to create good representative installations which show the strides made in recent years in the development of the art of lighting. With these concrete examples before him, the merchant across the street is more than ever ready to modernize his lighting facilities and catch up with his competitor.

Modernization of store fronts, interrupted during the depression, is coming to life again. Rather than stand still until he can build an entirely new structure, the aggressive owner again is calling in the architects to do a face-lifting job on the front of the building. Right here is where the company gets its opportunity to help create a new and outstanding landmark on Main Street. Much of the missionary work for this job is completed. This owner is groping for the newest in the electrical arts, and here is the exact spot where the new translucent panels, the 75-ft.-candle jobs, the neon Mazda combinations and the up-to-the-minute tube jobs become connected load and high-powered advertising for better commercial lighting. Of course there would be more load if the owner erected an entirely new building, wired according to 1936 standards, and requiring 1936 lighting. But even though the owner decides to revamp only the front elevation, many a kilowatt of new load will nevertheless be created and pave the way for other kilowatts to follow.

There is a broad assortment of establishments lining every Main Street, and the utility company is going out for a larger share of the prosperity now touching a larger number of these customers.

Brooklyn Edison equips its commercial business getters with books which tell of load-building possibilities in everything from accountants' offices down to yarn shops. Philadelphia Electric uses the book, too, and when one of these salesmen walks into an addressing shop he knows there are at least nine load applications. Down at the other end of the alphabet is the woodworking shop, for which seventeen applications are listed. The prospect card in Philadelphia lists 56 specific applications for checking. These boys do not go into a place expecting to sell only a 100-watt bulb!

Inside the shops and stores of Main Street clerks, waitresses, salespeople, chefs, cooks, managers and owners make up a conglomerate market for the new shining coffee makers, fry-kettles, grills, toasters, steam tables, ranges and ovens now available at appealingly low prices.

Highway and street lighting

During the depression many municipalities decreased street illumination to save money. Up went the accidents. Today the highway departments, the automobile industry and all safety organizations should be ready to aid the industry in selling adequate street lighting. Traffic and accidents are increasing. The answer to the problem is more lights and better lights and the electrical industry has the equipment to do the job.

There is an increasing tendency toward having all major highways lighted, as well as intersections of highways. Sample installations in New Jersey have been duplicated in other states. Rural electrification and increased automobile and truck traffic have expedited the development of this business.

The promotion of better lighting of our schoolrooms is enjoying a renaissance. For example, the New York schools are undertaking experimental lighting under the supervision of the Illuminating Engineering Society. Pittsburgh scholars are enjoying the benefits of up-to-date lighting in many of their classrooms, with certain circuits now controlled by the "electric eye." Students in the fifth, sixth, seventh and eighth grades of Chicago schools participated in extensive tests to determine a desirable, comfortable lighting intensity in the average classroom for students, 18 per cent of whom had been found to have defective vision by Chicago Board of Health tests.

Predictions are dangerous, but it does appear that the combination Mazda lamp-mercury tube light is only getting started. Today's example of modern interior lighting—the windowless office building at Hershey—uses this fixture.

Verily, the outlook for the commercial load builders appears auspicious. There is more money in the customer's till. He has already earned a rate for electric service which is even lower than the rate he now pays in his home. He looks upon his electric bill as a necessary and justifiable cost of doing business. He buys his kilowatt-hours by the dozen and he ties up less capacity. Such a combination of facts, beyond any doubt, will continue to stimulate the efforts of commercial load builders.

The American Home

Only a house until the three-wire service is connected and the resources of the public utility company change the house into a home

Increasing Domestic Use

"THE INDUSTRY TODAY" continues its persistent consistent application of man-power, money and methods to the progressive problem of selling its way back up the hill to establish itself more firmly on the solid fiscal base so necessary to a continued happy existence.

Time has shown that no other program will or can enable the utility company to regain the position so earnestly desired alike by customers, employees and stockholders.

Since the first surprising upward "inflation" surge of 1933, however, the utility company has applied itself to a longer range and more analytical plan of selling itself out of trouble.

The domestic customer has been a rock of Gibraltar during the dark days of depression-years. Since his income has become more assured and increased by a few dollars, the utility company has been alert to supply him with the added conveniences he and his family have desired for so long.

The time has come when he is being more carefully analyzed. *His* needs, *his* buying power, *his* "capital investment" to secure service, *his* ability to meet the various monthly payments have been sought out and weighed by the progressive sales manager. Straight out-and-out market analysis, as contrasted to the mere extension of lines on a sales bogey chart, has become the order of the day.

The price of the product has been steadily reduced, the reliability of the service steadily enhanced, and upon this co-operative basis the astute sales manager and his force have gathered sales momentum. Out of this teamwork have come records which would not have been given serious consideration as recently, say, as ten years ago.

There is more realism in the sales plans of 1936. The misleading over-all average for the specific company is being broken down into its components. Generalizations about "saturation" are being held up to the light of cold analysis. With the price of the product at a new low the modern sales manager is deploying his men so that their efforts are invested in the worth-while areas that yield new business, from customers who stay on the line, profitably use the service and can readily meet the well-rounded schedule of payments.

Eloquent proof of excellent selling is the disposition in a half dozen widely scattered spots to trim sales expenses, actuated by the very human urge to "coast" a while and round out the balance below the line. Such a policy would seem to overlook the fact that the sales manager today is a different man than he was in 1928 and 1929. Instead of a mere enthusiast, he is more of a realist. He is directing his power more skillfully, eyeing his market more analytically and subjecting his efforts to continuous practical tests. Salesmen, transportation costs, home economists, campaigns, bonus plans, sales schools, co-operative selling demonstrations, ratios of added revenue to added expense, sales inducements, dealer relations, employee sales programs, bogies and budgets—these are some of the elements that pass periodically under his appraising eye.

Given a continuation of the present rising tide of business, with the present all-time low prices for domestic electric service and a business-like appreciation of their tasks and problems, the wide-awake sales forces in the industry today will grasp a dollar of revenue, good this year and next year, for a sales expense incurred in only one year at a cost ranging

from 85 cents per dollar or even more down to 16 cents per dollar.

The last two years have given ample evidence that the operating forces of the utility company have planned well. The "big three" deliberately selected for domestic load building—refrigeration, cookery and water heating—have more than justified their selection. Intensive sales effort, coupled with the intelligent co-operation of the manufacturers, has brought a consumer acceptance to electric refrigeration that is now resulting in comparatively lowered bonuses, and more willingness on the part of the utility companies to intrust the electrical dealer with the refrigerator load-building program.

The electric refrigerator of five years ago, which used 600 kw.-hr. and had a useful life of five years, is being replaced by a refrigerator using about 350 kw.-hr. and with a probable life of ten years. Here is posed a sales problem that can be solved only by even better selling.

The case-history of the refrigerator may in future be duplicated by the range and even by the water heater. The popularity of the kitchen modernization plan evidences the vital interest in promoting major load-building appliances, for the plan focuses the home manager's attention on the "big three" as highly desirable elements of her kitchen.

The job of lighting the homes of the nation still constitutes the broad base of the industry's business. Renewed emphasis upon the importance of this load comes from the Better Light - Better Sight campaigns and the attention they have directed toward the old-fashioned levels and methods of illumination. It takes men and it takes money, but "the fellow who spends his working days looking for new revenue" recognizes that lighting and the minor appliances are still the best wedges for raising the low-use customer up to the point where he begins to pay his way.

The domestic customer of this year and day now chooses from an impressive array those inexpensive electrical devices that change his house into a home. Year-round air conditioning for his home now becomes more practicable. Responsible manufacturers are now releasing to the marketplace room coolers with air-cooled compressors, for example, and the retail price tags on these devices tell their own story of excellent co-operative marketing sensibilities on the part of manufacturers.

Twenty million domestic customers, comprising 83 per cent of the total number of public utility customers, have received and will continue to receive the unremitting attention of the industry. There are more of them now connected to the lines than ever before and they are buying electric service at the lowest price in history.

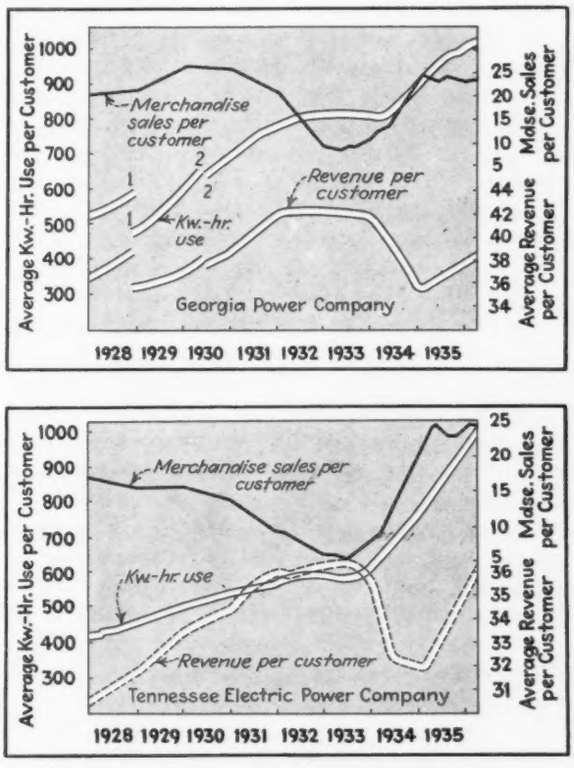
It is inevitable in a country as large as ours that utility companies in various parts of the nation operate under widely varying circumstances. Differences in climate, erudition, earning power and philosophy play their part in molding that group of domestic customers with which a utility company must deal, and deal successfully.

Yet, granting full allowance to the fact that there is no "average customer," it is of some interest to glance at data (ELECTRICAL WORLD, March 14, 1936) showing that last year:

1 customer in 19 bought a refrigerator.
1 in 33 bought a washer.
1 in 55 bought a cleaner.
1 in 90 bought a range.
1 in 250 bought a water heater.

Certainly, the selling job in the domestic field will take time, thought, effort and money. But the above figures, comprising 1935 results for companies serving half the domestic customers in the United States, constitute a challenge to the management and the sales departments of the nation's utilities.

These figures are indisputable evidence that today the way out is to sell. The domestic customer has a little more money in his pocket now, feels more secure in his job, is more receptive to the services made available to him by his public utility company and costing him less than they ever did. Further analysis of his needs and of his purchasing ability will expose fruitful fields for intensive sales effort. Out of the effort will come new business on an economical basis, new friendship and added net for the utility and a continuation of the steady march of the industry to new heights.



Two utilities selling fast to recover gross; other properties acquired at 1, 2

Serving the Farmer

THE rural dweller has for years represented to the utility company one more prospective customer which the company would like to add to its lines. By "rural dweller" we mean the individual who lives in a farmhouse, surrounded by acres of land and deriving his principal livelihood from agricultural pursuits.

'Way back in the dim distant past of 1923-1924 about 178,000 farms were receiving electric service from utility companies. Since that time the number of farms served has quadrupled to a total of 794,000 —more than three-quarters of a million farms. In the year 1928 alone 113,000 farms were connected to electric distribution systems.

Before these figures are paraded any further, there are some cobwebs to be shaken loose from the figures on farm electrification so often observed scampering around in political speeches.

We can start by rejecting the figure of 8,000,000 farms mentioned last month by a prominent political leader, and begin with the Census figure of—to be exact—6,288,648.

A farm without a house on it is of uncertain interest to a utility company, and the same might be said of a farm with a house, but a house that appraises at less than $500. The Census tells us there are 400,000 of the former and 2,516,000 of the latter. The Edison Electric Institute reports some 160,000 farms now reached by power lines that do not use electric service.

These figures represent a lot of cobwebs to be shaken loose from one starting figure. But after all, the utility company owned by private citizens and operated without benefit of subsidies from the taxpayer has to look realistically at its problems or go out of business. Therefore let's realistically dust off 400,000 and 2,516,000 to get down to a working figure of 3,373,000 farms. Each of these farms has a house and the house is valued at $500 or more.

As 794,000 of these 3,373,000 farms are now customers, then, for a starting point, we have a ratio of 23 per cent to tell us something of how much work has already been accomplished. We see that on this basis about 77 per cent of the farms are not yet on the lines, and this figure includes that one farm in six which is reached by an electric line but does not take service.

Two-and-one-half-million farms would seem to present an imposing block of prospective load for the companies. As every one in the business knows, there is a load to be served, but in a matter-of-fact world there arise two matter-of-fact problems:

1. Where is the money coming from to get the service to these farms.

2. When the service was brought to the line side of the meter, would and could the customer buy and use the equipment necessary to justify the line, and, as well, pay the monthly bills?

The fact that 50,000 farms were connected to public utility company lines during 1935 is proof that the industry has approached a solution to the first problem.

The company engaged in trying to earn one dollar per year for every five dollars invested in property has plowed as much as ten dollars into a rural line to reach for a dollar of revenue. If the company allocated to the rural extension its pro rata share of generating station, transmission system and other investment necessary to supply the rural line itself with power, where would the ratio go? Competent commentators say it would climb to twenty dollars of plant for one dollar per year of revenue.

Yet the industry goes ahead in the face of these practical limitations and the line trucks load up with crews and materials for more rural lines.

The engineer has focussed his ingenuity on the problem and evolved sturdy, good-looking lines at new low costs. Manufacturers have co-operated on the problem by designing more modern equipment especially adapted for rural line use. The most modern rural construction is simplified to the point

where the first impression is that the construction job is not yet finished. The rural-line-to-be will not deign to follow winding country roads, with tree-trimming problems and a guy on every fourth pole. Instead, it will leave the road just before it begins its tortuous roller-coaster route, it will short-cut the curves, ride clear across the gullies and dips, sidestep trees and fly away in long spans across fields and meadows toward the next customer.

And the public utility engineer will design lines which, as usual, stand up summer and winter.

The farmers' payments

Much as the investment necessary to serve a rural customer has already been and will be further reduced, the sales division still faces problem number two. Will the prospective rural customer have his farm wired, buy the equipment he needs, use it and pay the monthly electric service bill?

This is a question, or a series of questions with which the sales manager will have to take his chances. Complete data are not yet at hand which would permit the construction here of suitable guideposts.

Data are available, of course, on results of earlier years. But this year's problem concerns the characteristics of those customers who were connected last year and the actual operating results they provide as a guide to this year's new rural customers.

This year the sales departments are running into less desirable rural business than they ferreted out just a year ago. There are fewer customers per mile of proposed line. These proposed customers seem to want electric service, but the salesman often wonders where the cash is coming from to wire the farmhouse, where the cash is coming from to make the small down-payment or rental on the appliances, where the cash is coming from to pay the electric service bill, even with farm rates at their lowest levels in history.

Seldom indeed will a rural extension serve a factory or mill, with a fat block of power to carry the burden of the fixed charges on the extension investment. Instead, the necessary estimated annual revenue will continue to come, by and large, from long-hour use of a variety of devices spotted upstairs and down in the house, out in the barn and about the farm. It is well known that a few electric lights in the house and a fractional-horsepower motor in the barnyard will not support the line which is charged with its proper share of capital investment, much less the added operating expenses.

These problems are not new. As the industry knows so well, they have been faced and solved in progressive fashion for a number of years. Nevertheless, this year the inexorable economics of the ratio between estimated annual revenue and investment present a steeper hill to be climbed.

While new rural line extensions are stretching like fingers into new territory, a second major field of rural load building has meanwhile been created. In this second field is the farm already connected as well as the one home in six which is adjacent to the line but does not take service. Some leaders of the industry, thoroughly versed in the relative costs of load building, look upon this second field as the answer to the rural electrification riddle.

Here is where the 20-to-1 ratio is being tackled. Assuredly a farmer should present a market for all the home uses of electricity, and until the farmer who can pay for complete electric service receives it, the rural electrification job is not finished. For some time the leading electrical manufacturers of the country have been applying themselves to the practical development of more long-use electrical devices for use in the rural sections. Dairy refrigeration, soil heating, soil sterilization, lighting for improved egg production, ultra-violet for poultry and plant growth are a handful of new uses illustrating new trends.

The further development of field number two, comprising rural customers with limited usage, will indeed proceed at an accelerated rate. For in their case, the money has been raised, the line constructed, the farmhouse wired and the taste acquired for modern electric service.

The rural service salesman this year drives into the farmyard with new appliances, new ideas, more experience and high hopes. The appliances he offers are more efficient, better styled and lower priced. The rural rate is simplified, tempered by expediency, scientifically designed and lower than ever. His company authorizes him to offer more attractive payment plans for extensions and appliances, plans that have been evolved from first-hand experience with the prospective rural customer and the problem which he presents.

Management, engineers, rate experts and salesmen will solve the 1936 problem to the tune of at least 50,000 new customers. Six months hence the industry will establish another new high in the number of farms served, and the 1935 total of 793,977 will become only one more milestone in a record which has been exceeded year by year without interruption ever since they began listing the figures thirteen years ago.

Probably the most serious deterrent to expansion of industry on a broad scale is the endless effect of increased taxation—the great tax burden put upon the dollar in its every step as the wage-earner starts it on its way through the retail store up to the wholesaler and the manufacturer. — WILLIAM H. TAYLOR, president Philadelphia Electric Company.

Three Zones of Legal Warfare

A VISITOR from across the international boundary line surveying the national scene of "The Industry Today" from legal and legislative angles would need a practiced eye to encompass all of the battlefields currently engaging the attention of publicity utility men.

While the great majority of public utility people are busy with the task of making and selling electric service, a smaller number are engaged with the vital problem of preserving these properties for the real owners. For despite all that has happened, no new dealer has as yet said, publicly, that the commercial utility company in the United States is no longer private property.

The battle of the whereases, hereinaboves and provided howevers proceeds in three general zones. In the lower zone are the skirmishes with the city and town; next above are the engagements with state authorities, and on top we see the major encounters with national bodies. Perhaps the most remarkable phenomenon at this time is that all of these difficulties, with scarcely an exception the country over, are between U. S. citizens and their own governmental bodies.

There is nothing new in the observation that all of the expenses, all of the fees and all of the costs are to be paid for, ultimately, by the public.

The reason we do not object to the uselessness of many of the expenses of litigation is because you and I are not "the public." The public is 122,999,998 other Americans.

With the important issue of who pays the bill in the end disposed of, we may proceed immediately to a survey of the courtrooms, glance at what has been done and point out the more important log jams.

A great many of the questions which arise in the reader's mind can be answered in advance by remembering that many company executives in the industry today must feel that their big job is to hold onto what they have, not for themselves particularly, but for their thousands of employees, with added thousands of dependents, existing by virtue of a payroll of $850,000 *per day*. And this payroll, it may be remarked, was never paid in scrip.

Small wonder, then, that doughty leaders of the industry today are utilizing the best legal talent in the 48 states to resist the attacks foreseen so clearly ten years ago. The utility company president who should be investing his time in constructive development of his business for its customers, its employees and its owners, instead is obliged to obey the first instinct and keep his eye on score cards such as are shown in the accompanying panels.

This indeed is a sorry record to contemplate in a nation such as ours, so sorely in need of the constructive assistance which would be rendered by a thirteen-billion-dollar industry if it were not hampered by political attacks.

May ELECTRICAL WORLD, 62 years old, and antedating the industry itself, here indulge itself in a look ahead?

There will be no new remedies proposed for this deplorable situation. The coming year will see, however, a more intelligent application of the old tested remedies. For example, these men who set meters

Litigation Under the Public Utility Act of 1935

I. Settled:

American States Public Service—Act held unconstitutional as it applies to plaintiff and plaintiff's trustees; review denied in Supreme Court.

Utilities Power & Light—Company registered when stockholders failed in an effort to enjoin such action.

II. Government's "Hand-Picked" Test Case

Electric Bond & Share and associated companies—Government counsel are seeking to force those holding companies to register with S.E.C.; suit is before U. S. District Court in New York City and has not yet been heard.

III. Injunctions Sought

Most of the major interstate systems, including American Water Works, Associated Gas, Cities Service, Commonwealth & Southern, Consolidated Edison of New York, North American, Standard Gas, Stone & Webster, United Corporation, United Gas Improvement and United Light & Power, have asked injunctions which will enable them to avoid registration.

The government has asked for and/or secured stays in most of these cases in order to gain precedence for its own chosen test case.

American Water Works and North American have appealed from a stay (granted in D.C. Supreme Court) and have argued their appeal before D.C. Circuit Court of Appeals.

IV. Restrained by Stockholders

Central Public Utility Corporation.
Columbia Gas & Electric.

years ago, worked on line gangs, slaved through sleet storms, floods, hurricanes and panics, know what it took to keep everybody happy. These are the men who can still put a set on the line, still do a pretty good job at calibrating a watt-hour meter and still know how to use hooks on a pole; these are the men who now know the fundamentals of what it takes to get along successfully with the run-of-mine American public. And while the lawyers hold the front line, these men at the top of the industry, who understand from experience what makes its wheels go round, are the men who will *present the public utility company as it really is,* and present its case with huge success to the great American jury.

"I told you so" is a provocative pill, but how well it could be used by the industry today. Every time a newspaper headline screams of a new attack on American business—every time a business man snaps off the radio blatting of some new political angel of action—every time crass, impudent, undemocratic, un-American hands reach to rip away another private property right—every time this happens nowadays, our utility man, if he wishes, might adopt the jargon of the day and reply, very simply, "You're telling me?"

Ten years ago the far-sighted Dows, Mullendores, Fergusons and Gruhls told all of us what was ahead. They told insurance companies, they told banking houses, they told the heads of great businesses, they told civic clubs, they told publishers, they told all who would listen.

Strange to say, two great advantages now arise out of the dust of these memories. There is the realization, both too true and too shameful, but at least generally realized (1) that these prophets "called their shots" successfully, and (2) that the butcher, the baker, the candlestick maker and the utility company now face a common struggle for their continued existence.

The industry today may well give thanks that the political elixir of a more abundant life has been ladled out so widely, so fast and so furiously as to drive the people, if anything, *closer* to industry as a whole.

Every time a chain of newspapers explains the Bill of Rights in 72-point headlines and the language of the street, every time a sick chicken case squawks its last before nine gowned men, the utility industry can mark off as "finished" one more job which heretofore it had tried to do alone.

The current desperate political fad of making everything "okey-dokey" for everybody all at once has moved the public utility industry off the innermost circle of the target. The odds now are that so many industries will be under continuous political attack and so many holding company forms in all businesses will be fighting destructive taxation that the far-seeing leaders of the utility industry, gaining more and more company in their misery, will continue to batten down the hatches legally, continue to carry as much sales sail as is thought prudent, and in this wise ride out the storm.

Certainly to the observer in a "weather bureau," such as ELECTRICAL WORLD, the very fury of the storm augurs all the more for its earlier termination.

Litigation Involving P.W.A.

I. Little T.V.A. (Nebraska)

Utilities and P.W.A. agree to seek a "full trial" to test legality of generating and distribution phases of project; work on irrigation projects proceeds while most of power line construction is halted; P.W.A. moved to postpone trial to fall of 1935.

II. Buzzard Roost

Duke Power filed appeal from Circuit Court decision declaring project legal. (P.W.A. and Greenwood County, S. C., defendants.)

III. Santee-Cooper

Cases pending in South Carolina District Court and in District of Columbia Supreme Court.

IV. Texas Projects

Seven utility companies secured limited temporary injunctions in D. C. Supreme Court against Lower Colorado River Authority loan of $20,000,000 and Brazos River Construction and Irrigation District.

V. Puerto Rico

Injunction sought against $7,000,000 for five dams and power projects.

VI. Loans for city plants

Municipal projects in nearly 60 cities tied up by legal proceedings. (See also T.V.A. II.)

Litigation Concerning T.V.A.

I. Wilson Dam Decision

Wilson Dam case decided by the U. S. Supreme Court; construction legal under the war-time emergency powers through which it was launched and its navigation features also were upheld by the high court; incidental power production held a proper adjunct; transmission line construction necessary to market this supplementary power upheld.

II. Memphis, Chattanooga and Knoxville

Memphis—D. C. Supreme Court issued temporary injunction against transfer of P.W.A. money to city (Memphis Power & Light.

Chattanooga—D. C. Supreme Court issued temporary injunction against transfer of P.W.A. funds to city (Tennessee Electric Power).

Knoxville—Tennessee Public Service secured temporary injunction against P.W.A. in suit in D. C. Supreme Court; original suit in state Supreme Court dismissed; temporary restraining order against city issued in new suit in state court; no P.W.A. funds available.

III. Potential Litigation

Constitutionality of Norris Dam?
Constitutionality of other dams?

Status and Trend of Rates

IMPORTANCE of the undeveloped home load was thrown into sharp relief by the sustained patronage during 1929-1935, when other loads sagged. It was quite natural, therefore, that many forms of rate inducement should be devised to encourage this particular load. Household rates still are attracting the major attention, even though commissions have usually insisted and companies have often acquiesced that company-wide adjustments should also do something for commercial and industrial users.

Recognizing that rate attractiveness alone will not create increased usage, a variety of measures have been introduced—uncharged for energy increments or "half-off" on increased use, appliance subsidies, wiring contributions, dealer aids, financing carriage on appliance purchases.

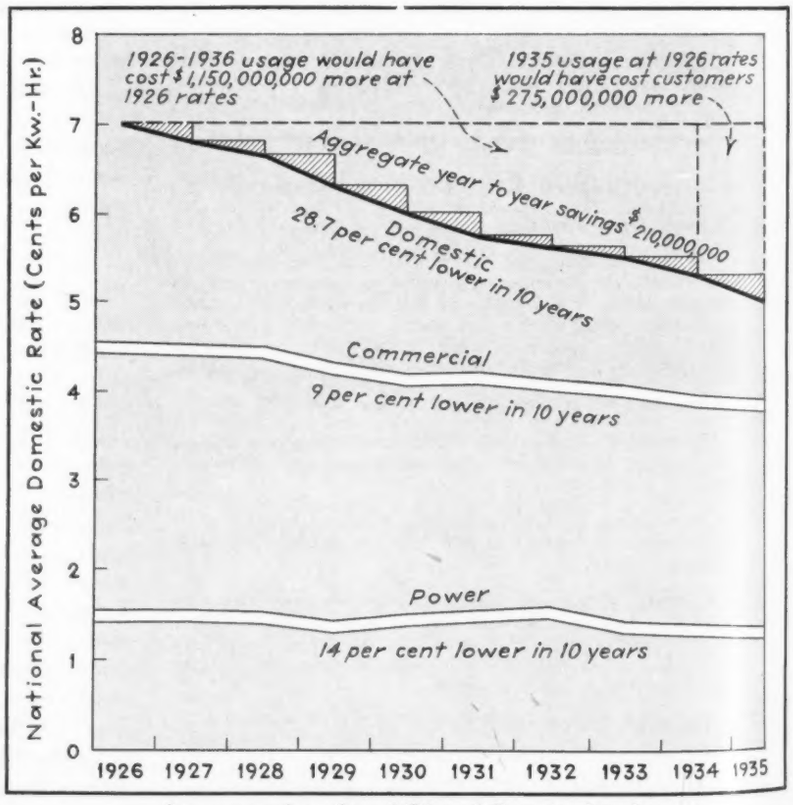
The companies of the Southeast set a wave of objective rates in motion. During 1935 fifty companies introduced objective rates in which an especially attractive price is offered for energy consumed in excess of a base bill. The base bill, generally speaking, is that of the same month a year back. In all but six of these 50 objective rate schedules the last block offers a price of 2 cents or less; 28 of them make the last block 1.5 cents or less, and eight of them make it as low as 1 cent.

An interesting point is the spread in the value of kilowatt-hours at which the tapering stops. Naturally the higher values of cents per kilowatt-hour in the last block are in schedules in which the last block begins after from 35 to 200 kw.-hr. Fourteen of the twenty rates with 1.5-cent terminal figure make this value apply in excess of 200. Seven of the companies (largely in the Southeast) make a 1-cent rate begin at 700 kw.-hr. To some extent, the wide spread in these last-block beginning points may indicate the expectation of the companies as to the degree to which the rate may prove effective in enlarging usage.

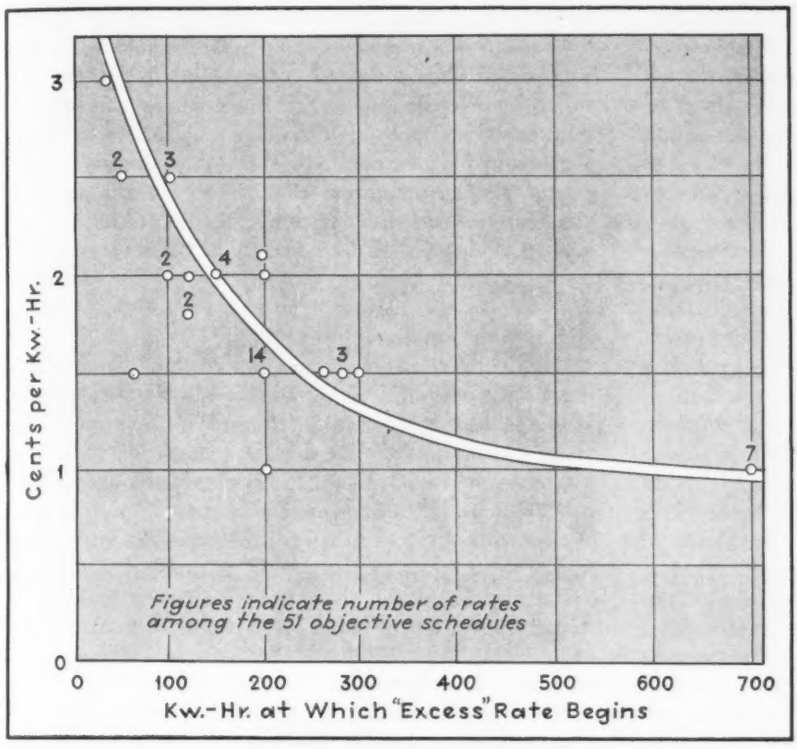
A noticeable trend in form is that these objective rates have fewer blocks than the "immediate" rates which accompany them and the blocks, in general, break sooner. Another trend is that they more often have an absorbable minimum feature, in which 10 to 20 kw.-hr. are covered by the minimum bill. The minimum is often increased in amount. Room area rates are less common and there are fewer of the Wright-demand, room-count type. Arkansas and Wisconsin rates are graduated to a population scale. Very few resort to off-peak provisions to establish an extra low rate for water heating. Four have a rising-tax adjustment clause.

As a consequence of such measures, in addition to reductions in the conventional manner the domestic consumers are today buying at substantially less than 2 cents per kilowatt-hour the increased energy they have taken since the depression started. All this while reductions for the confirmed or temporary minimum user have been relatively small, as they should be. The announced desire of government is that homes may use electricity freely. This is likewise earnestly desired by the industry. Promotional rates effectuate the objective because they retain revenue now received for prevailing usage and offer a lowered price for hoped-for but as yet non-existent consumption. Every unearned reduction to minimum users thwarts the program of the industry.

Merely satisfying political clamor is no way to



Consumers benefit a billion dollars in decade



Objective schedules reflect varying last-block policy

"Excess" at lowest rate begins at 35 kw.-hr. per month in one instance, but not until 700 in seven others; the rate is 3 cents in the first instance and 1 cent in the latter. The numbers beside the points represent numbers of schedules.

serve the best permanent interests of users or company. The true objective is a public satisfied alike with the monthly bill, the quality of service and the degree of persuasion put upon it to equip with appliances and use them. These are proving to be the three-cornered measure of promotional rate effectiveness. In the process the determination of rate details is less than half the problem. Organized selling, molded public attitude, advertising, co-operation with local dealers, employee loyalty and zeal are equal or greater components. In Georgia Power these measures conspired to drop the 0.20-kw.-hr. customers from 28 to 23 per cent in two years and raise those over 70 kw.-hr. from 25 to 34 per cent. In Alabama and Tennessee there were comparable results.

Promotion cost accompanies revenue reduction

Companies are naturally finding a temporary double loss when rate reductions are volunteered or ordered. One is the immediate loss in revenue from existing consumption. The other is the net cost of promoting the net earnings to the requisite level of profitableness. Intensified sales effort and unniggardly outlay have regularly been found necessary if delayed recovery of revenue is not to absorb an undue amount of surplus temporarily apportioned to business promotion. Low rates in themselves are a candle hidden under a bushel.

Quicker break in the blocks and moderate trend away from charges fixed regardless of consumption have constituted the major changes which have taken place in rate forms. In Wisconsin the opposite trend is manifested, the commission there having established the fixed charge of 60 cents as the first component of the "Low Cost" residential rate advanced in January, 1935, as a goal for all electric companies.

The federal survey reflects this trend, incidental to disclosing well-known differences in regional rate levels. Not enough acknowledgment is given in the federal reports to the logical reasons for these differences. Rates quite properly reflect differences in degree of industrialization, population density, earning capacities, labor and fuel costs, topography, social habits, climate, proximity to competitive oil and gas resources, etc. These affect both the electrical potentiality of users in all brackets and the cost of generating the energy and delivering it. They make for rate differences that defy a horizontal leveling dictated from Washington.

Reductions in rates still are so common as to constitute a wave, a mass movement and a major index of the new outlook of the power industry. Nevertheless, rate adjustments cannot be made with safety by an industry so committed by necessity to fixed-capital facilities unless there is a reasonable assurance that increased consumption will follow and be sustained. The greater the promotional plunge the greater the call for analysis of past and prospective sales. As a consequence, a major aspect of the trend of rates as to form and magnitude resides in the simplification and betterment of records and of methods of analysis to ascertain past and probable future response to altered charges for service.

Rate forms are moving steadily toward less complexity. Rate background analysis, on the contrary, is moving toward greater complexity. Promotional effort to lift into higher brackets some respectable portion of the 11,000,000 or so customers that still use no more than 40 kw.-hr. per month encounters factors that have assumed new prominence. Cold extrapolation of curves that reach back through a severe depression into an even less indicative past does not suffice. What impediment is offered by the prevailing cost of major energy-consuming appliances? What is the handicap in inadequate wiring? What are the income-earning and spending capacities? How fast is recovery to ensue? How nearly has America been made electrically conscious? How will rate inducement

and the facilitation of acquisition of appliances share the cost of getting the devices where they will be users of energy? Hardly any of these elements can be set down in authentic figures. Nevertheless, data must be analyzed to determine what influence they have had and may have. Promotional policies may be changed overnight, but an announced rate is hard to change in any direction except down.

Statistical analysis on a continuous basis seems more important than ever. It affords the essential and inescapable facts which provide the core of the decision to make a rate change. It tells how to direct it toward an objective increase in lucrative load, one that will contribute more on the side of gross than on the side of outlay. Much of the recent literature on rates is thus naturally devoted to improved technique in analysis. Business prognostication, short cuts to plotting the probable shifts of consumption brackets as rate inducements take hold, simplified methods of compiling usage trends, machine methods for analyzing past and current consumptions, correlation of the consumptions with the prevailing rate and its inducement features—these appear to be the current activities of the rate specialist.

Raters meet distribution and metering

Reaching for marginal increases is bringing the rate engineer into increasingly intimate contact with the distribution engineer and the sales manager. The narrower the margin of profit the more the problem becomes a closer reconciliation of the price with the cost to serve the added load of particular groups. A correlation of the prospects of increased revenue from existing customers responding to the rate stimuli is also becoming more important. Offsetting these complicating factors is the expediency of making the rate as uniform as is feasible for each class of users over the entire area of operations.

The meter superintendent watches all these meditations and maneuverings of the rate specialist and wonders whether metering will fade away entirely or become even more intensive. At the moment he has assurance that the art will persist, but he has no assurance that two meters, two-rate meters and time switches will not be more the trend than a single orthodox meter. As fast as one company finds it can dispense with off-peak rates and metering for water heating, another that has been laggard enters the field by the off-peak route. The trend is thus very definitely toward the adoption of more off-peak practice.

Growing importance is being attached to demonstration of rate efficacy by plots of cumulative percentages of customers who use certain progressive amounts of kilowatt-hours per month. If the rate works as planned and sales methods are correspondingly successful the curve moves consistently in the desired direction in successive months. Zuck (ELECTRICAL WORLD, February 15 and March 14) has shown how rectification of these probability curves by reference to a special scale gives a quick index of the working of a new promotional program.

Part of the transaction between customer and utility has to do with the terms and conditions of service. There is less uniformity in these "application" provisions than in the rate details. Many of them are traceable to tradition and to local matters of evolved practice. In the minds of the migrating public and of those who profess to speak for the more-established public these items are of nearly as much consequence as the details of the charges themselves. There is a rising disposition to bring these practices more nearly comparable from company to company. The process will be a long one.

Rates are inevitably tied up with metering and with billing as a matter of execution. In advance of this stage there is the task of setting the rate to cover the costs of service to and return from all types of users, including even the minimum-use customer, if that can ever be accomplished. As a step in the latter instance some consideration could well be given to a lengthened interval between meter readings and possible billings. The appeal of the attendant rate adjustment would be expected to facilitate collection of an enlarged deposit to cover the lengthened period. This would, of course, go counter to the sustained trend of dispensing with deposits as far as possible. Credit extensions are increasingly liberal, however, in the field of general merchandising and some of the best technique might justifiably be adopted by the utilities to avert the resort to deposits.

As for the early future, the impending move seems to be a more intensive application of promotional pressure to the commercial users. Promise of enlarged consumption in that field accompanying business revival will, in the minds of many, outstrip the kilowatt-hour and revenue gains already accomplished with residential consumption. Power rates and power sales are a different matter and warrant a separate treatment.

Gains have been made in the face of handicaps, not altogether economic in character, but, in a measure, artificially created, and if our industry were relieved of the uncertainties and drawbacks fairly chargeable to existing political conditions we could look to the future with a feeling of real optimism.—THOMAS N. McCARTER, president of E.E.I.

"The Industry Today"

Electrical World Presents a Survey of Representative New Products and Gives an Interpretation of Trends in Product Design and Application

Manufacturers Make Notable Contributions

Progress in the electrical industry depends upon the equipment it has to work with and to sell. It is notable for the research and development work done in the past and continues to be alert to opportunities to make new products and improve old products.

During the depression electrical manufacturers devoted time and money to research and development. The fruits of this work are now commercial products that fit new service and new market conditions.

Products shown and discussed in the following pages are not inclusive. They are indicative, however, of the splendid accomplishments of manufacturers and serve to point out the design trends in products that will reduce costs, improve performance and open new markets.

Reports are presented in the following pages on products applied in power generation, transmission, substations, distribution and general industrial applications. Illustrations used are chosen merely as samples out of the enormous number of new developments that have been made recently.

New Generating Equipment

With the depression fading out of the picture and load on utility systems increasing by leaps and bounds, power company engineers and executives are looking with increased concern at their existing margins of capacity. In order to make it possible for engineers to realize the maximum amount of incremental capacity economically possible from any scheme, new developments in turbines, alternators, boilers and auxiliary equipment have been introduced by equipment manufacturers.

Turbines—Among the schemes that are receiving considerable attention from both utility engineers and manufacturers' designers is that of superposing high-pressure turbines on existing low-pressure units. By this arrangement, plant capacity can in many instances be increased greatly and turbine heat rates in the entire plant reduced appreciably.

Pressures commonly used for superposition at the present time lie in two classes, from 650 to 800 lb. using 825 deg. F. and from 1,200 to 1,400 lb. using temperatures of around 900 deg. The amount of superposition with the first class, assuming 200 lb. pressure for the existing plant, varies from 50 to 60 per cent, while that possible for the 1,200 lb. may run as high as 85 per cent.

Newer installations have had varying arrangements for feed heating by extraction. Steam has customarily been extracted for feedwater heating from the exhaust of the high-pressure turbine and from two or three points in the existing low-pressure units. It occasionally happens, however, that the older, low-pressure turbines are not equipped with suitable bleed openings. To meet this situation, superposition of turbine units with feedwater heating has been made available which consists of two elements in tandem on the same shaft. Exhaust from the high-pressure element of the unit is discharged into existing 200-lb. steam mains which feed the low-pressure element of the new unit as well as other existing low-pressure turbines. Bleed for feed heating is from the 200-lb. system and from suitable points in the tandem low-pressure unit. In the Logan plant the superposed turbine has bleeding at the seventh stage of the high-pressure unit, as well as at crossover and in the low-pressure units. Attention is being given to the utilization of steam at crossover pressure for driving turbine-driven auxiliaries.

To reduce the pressure against the outer case of high-pressure turbines, to minimize losses from the turbine case and to modify the pressure differential across the high-pressure turbine case double-case turbine designs have been introduced within the year. In turbines of this type steam exhausted at 200 lb. pressure from the superposition unit was used to surround the inner high-pressure casing.

Governing of the new superposition turbines centers around maintenance of a fixed back pressure so that the high-pressure turbine will follow the low-pressure unit loadings instead of having the load on these units controlled by the high-pressure governor. This is intended to reduce hunting between the low-pressure units, where there is more than one. Maintenance of fixed back pressure also helps keep loading down on last stage wheels to safe limits above normal.

Generators—Difficulties experienced in obtaining satisfactory operation of large 3,600-r.p.m. generators has been largely traceable to the inadequacy of air as a cooling medium for large units at this speed and has directly led to introduction of hydrogen cooling as

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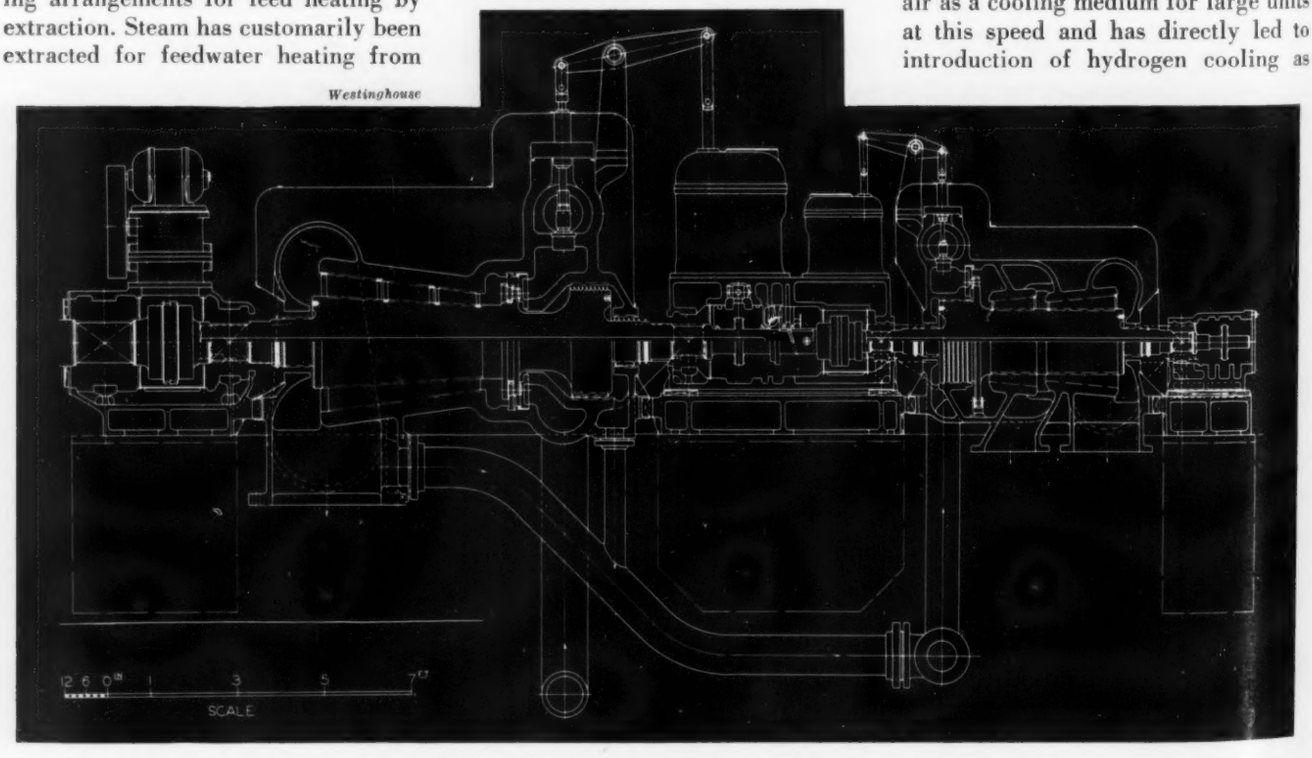

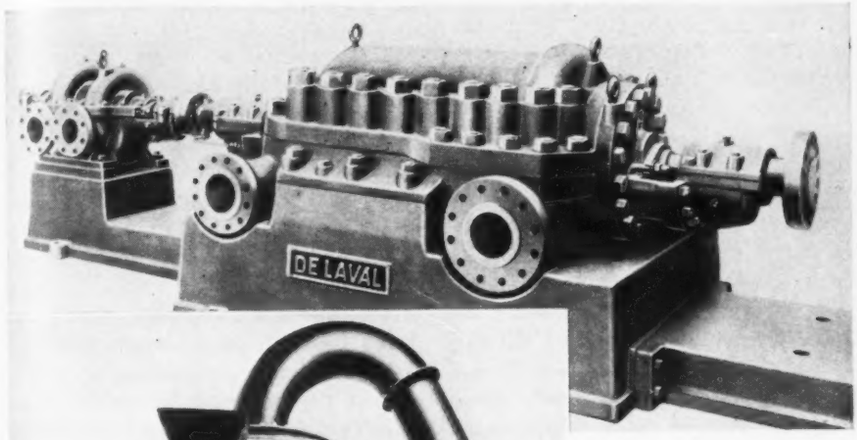

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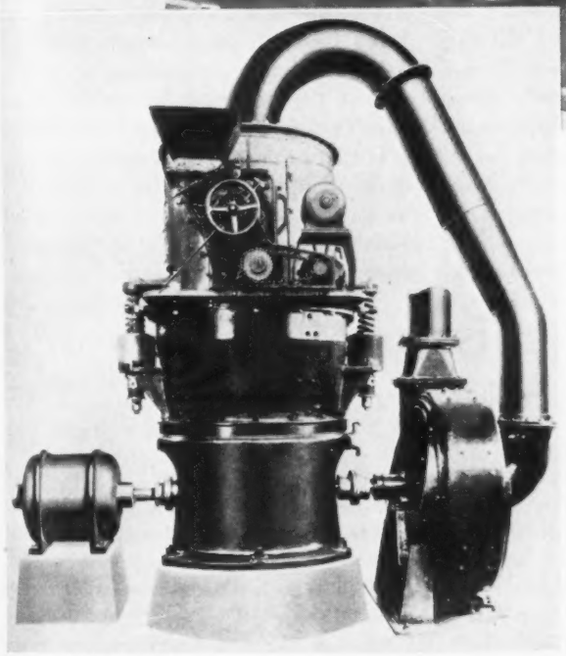


Combustion Engineering

a means of overcoming this difficulty in the newer designs. With the increased use of hydrogen cooling, a new range of sizes in 3,600-r.p.m. machines has opened up. Some authorities are pointing to limits of possibly 75,000 kva. for high-speed generators using this type of cooling.

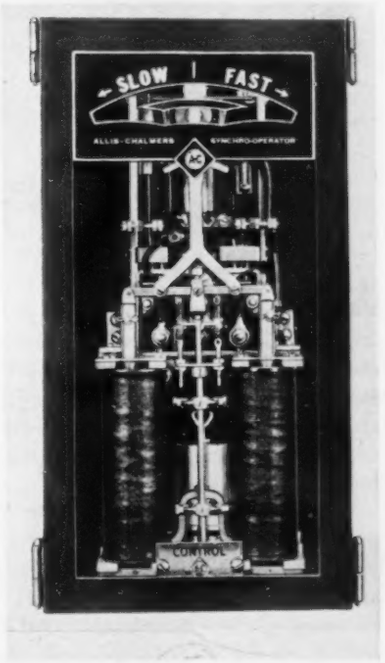
To supplement the use of hydrogen, more direct cooling is being resorted to by some manufacturers who use "water pads" to cool the iron and windings in the stator. Conventional air ducts in the armature coil are filled with hollow pads, through which water is circulated to take away stator heat and provide a means of cooling the circulating hydrogen gas as it passes over the pads and through the air gap between armature and field laminations.

Auxiliary Equipment—Use of high-pressure and temperature in central stations has necessitated improvements in the design of boiler feed pumps. Special attention in the newer designs has been directed toward improving methods for obtaining axial balance and for minimizing expansion effects due to the high temperatures encountered in high-pressure equipment, all with the idea in mind of obtaining better continuity and availability. A general design similar to the "Jaeger" type pumps was used by one pump manufacturer who employed a radial leakage joint past a balancing disk to overcome thrust caused by high discharge pressures.

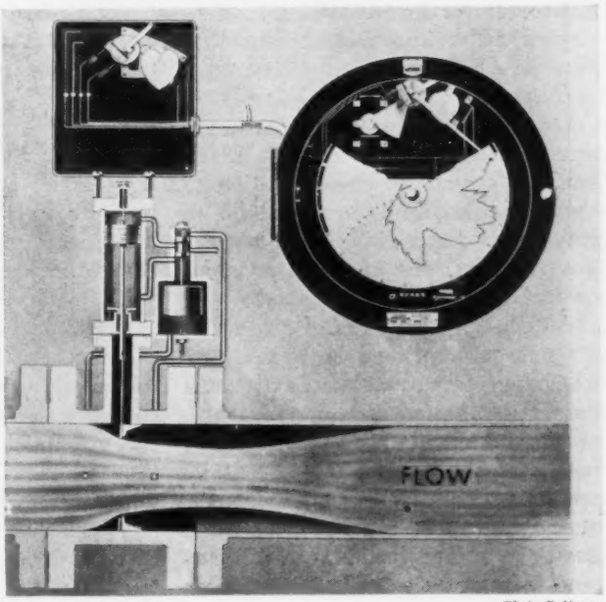
Pump impellers mounted directly on the motor shaft with both motor and pump bolted to one base are characteristic of one of the newer designs for light duty boiler return pumps. Balance rings are used to eliminate end thrust and put the stuffing box under suction pressure only.

Developments in variable-speed fan drives have now got down fairly definitely to the use of either (1) hydraulic coupling, (2) turbine drive, or (3) "Thyratron" motor drive. The latter is still in the experimental stage, however. Vane control with one or two fixed speeds is also being used to some extent.

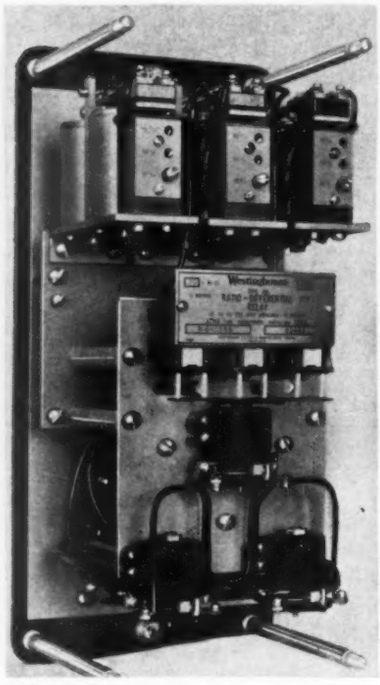
Bowl type coal-pulverizing mills for steam plants using either direct firing or storage systems were introduced during the year. A revolving bowl or grinding chamber is the unique feature of this type bill. Coal from the grinding ring works its way up the side of the bowl by centrifugal action, and as



Allis-Chalmers



Elgin Softener



Westinghouse

the particles reach the rim fine sizes are picked up by air circulating around the bowl and are carried to a separator for further classification. Oversize particles drop back to go through the mill again.

Circuit breakers especially designed to provide protection for power plant auxiliaries have been marketed which are in effect solenoid-operated circuit breakers of high interrupting capacity, which combine contactor and motor starter characteristics. Standard remote-control wiring and either momentary or maintained contact control is possible with these units.

Instruments and Control Devices—Controllers for regulating temperature, pressure, rate of flow or liquid level in a predetermined relation to some other condition are available to maintain a fixed differential between two variables, one of which is under control.

Automatic paralleling of a.c. generators is accomplished by a new unit which performs automatically the functions of speed matching, synchronizing and visual phase-angle indicating. Automatic synchronizing contacts are provided for closing the breaker at the instant of synchronism, while auxiliary relays handle control currents of the breakers and governors and also provide positive interlocks, preventing faulty operation. Operation is through potential transformer metering circuits.

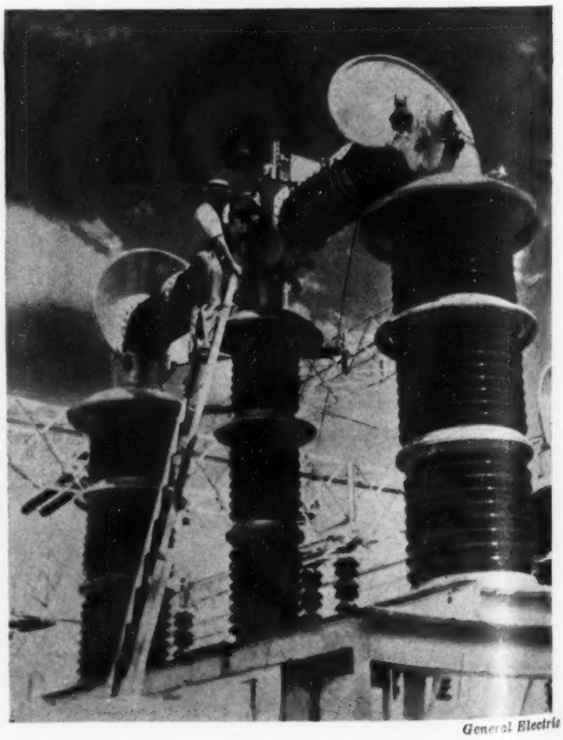
Variable orifice type recording flow meters of various designs have been introduced during the year to improve the accuracy of fluid flow measurements. Designs which vary the orifice diameter to maintain constant pressure drop across the orifice measure the orifice diameter to determine the rate of flow. Other designs introduce a two-position orifice segment which varies the size of the orifice opening with changes in flow rates. This widens the flow range in which measurements can be made accurately.

To provide high-speed protection for alternating-current apparatus and increase system stability limits by placing the protection of generators and transformers on the same high-speed basis now widely set for transmission lines newly designed ratio differential relays have been made available which have an operating time of one cycle and which reduce the chances of damage which might occur to equipment protected by slower speed relays. Since the operating current of the relay varies in proportion to the load, faulty tripping is prevented. This allows the relays to be set for close protection at normal loads. Generator relays may be set to operate on one cycle on internal troubles with current as low as 5 per cent of the smaller secondary current without danger of tripping on heavy overloads.

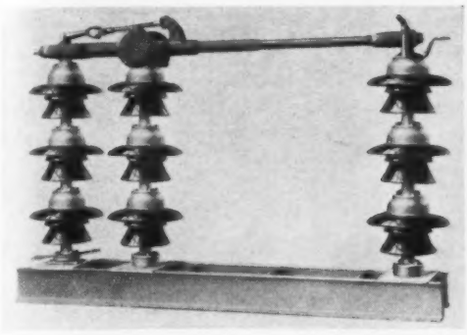
New Transmission Equipment

Although few high-voltage transmission lines have been built during the year, outside of those in connection with governmental projects, technical advances in equipment for this use have been made which are outstanding in many respects. Notable among these developments in equipment are: Perfection of high-speed, high-capacity circuit breakers, introduction of high-pressure oil transmission cable, advances in the design of terminal and sectionalizing switches and improvement in relays and control equipment. Design advances initiated by manufacturers, designers and power company engineers have been made with a view to reducing transmission outages and improving reliability and performance.

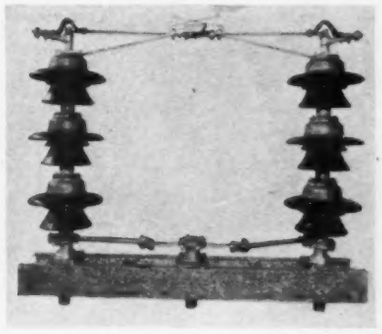
Underground Transmission Cable—Perhaps the two major limiting factors heretofore encountered in underground transmission cable have been voids in insulation and lead sheath failures. with a view to eliminating these factors high-pressure oil cable was introduced quite recently under the Bennett "Oilostatic" cable patents. This system subjects insulated cable to high oil pressure within a metal (usually welded steel) pipe. Pressures of 200 lb. per square inch are maintained in the pipe, which is approximately 50 per cent larger in diameter than the circle cir-



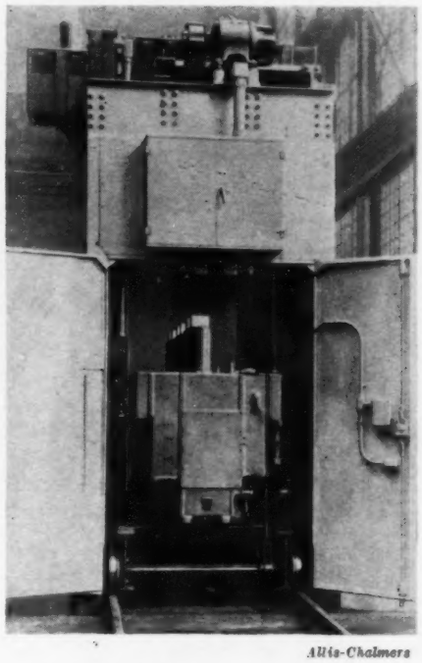
General Electric



Pacific Electric



Delta-Star



Allis-Chalmers

cumscribing the assembled non-leaded, insulated conductors.

Encouraging progress in the manufacture of ordinary paper and oil-filled cable has been had largely to eliminate sheath troubles and to get better oils. Research continues, but splendid electrical service is now had with standard cables.

Circuit Breakers (High Capacity-High Speed)—Because of the distance covered and the amount of power to be transmitted by the 270-mile, 287-kv. transmission line from Boulder Dam to Los Angeles extremely high-speed switching is required for stability.

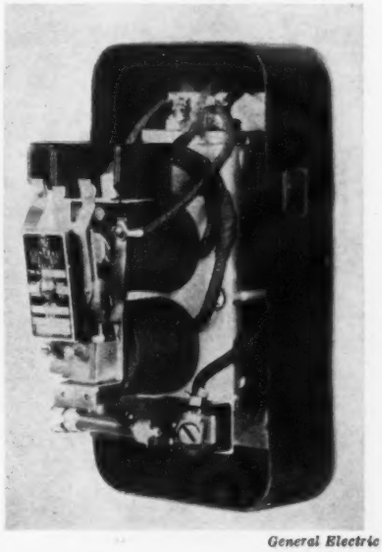
Principal novel features of one of the breaker designs are high-speed operation, 3 cycles from initiation of tripping impulse to interruption of the circuit, and small oil volume, about one-tenth that for usual design. The impulse oil-blast principle of arc extinction is employed. Each of the single-phase breakers required for the three-phase line is provided with two horizontal oil-filled interrupting elements, each containing four breaks and a piston to furnish the oil blast. The complete three-phase unit contains a total of 2,500 gal. of oil and has an interrupting rating of 5,000 amp. Another manufacturer has attained high speed and good voltage distribution in breakers for the same service by use of the Deïon principle in the conventional tanks.

Flexibility, ease of operation, easy and quick maintenance demanded innovations in low-voltage switchgear design to control the large blocks of power that will be generated at Boulder Dam itself. The 16.5-kv. breakers for this service, designed to interrupt 2,500,000 kva., require special arcing tips and utilize the expulsion-port turbulence principle of arc extinction. A motor-operated mechanism is employed which is trip free in any position of its stroke. Over-all closing time from the instant the motors are energized until the main contacts touch is approximately 20 cycles; six more cycles is required for the relays, making a total over-all time of 26 cycles.

Other breaker improvements were to use fewer parts, standard sizes, new silver or alloy contacts and welded unit assembly.

Disconnecting Switches—Trends in the design of disconnecting switches for transmission line terminals has continued toward securing rapid, effective breaking and easy operation.

The danger of ground flashovers on opening has been minimized by using a horizontal-plane break arrangement which carries the arc into the air away from the field of the insulators. Balanced blade designs for the conventional vertical-plane operation have been advanced that provide easy operation in the larger sizes and which prevent switch blades from falling open or flying shut in the event of any failure of the operating mechanism. Silver inserts have been used by some manufacturers in the contact surfaces to prevent formation of high-resistance oxides. Further refinements to insure easy operation include arrangements for completely releasing all contact pressure prior to movement of the blade on opening and likewise application of contact pressure only after blade travel has been completed on closing.

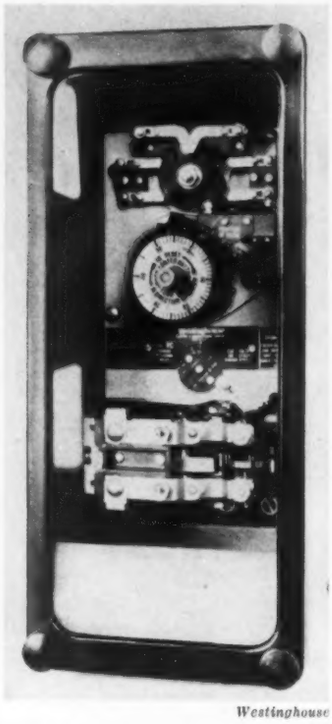


General Electric

For disconnecting and sectionalizing service on the Boulder Dam line 1,200-amp., 287-kv., motor-operated switches were designed which, although each set weighed 15 tons, were so balanced that they could be operated by hand. Rotating insulator type design was used.

Relays and Switching Controls—Relay designs have continued to move toward improved reliability, speed and accuracy for optimum continuity of service, reduction of breaker operations and the protection of equipment.

Detection of ground faults on normally ungrounded systems has been expedited by introduction of relays which can be made to trip breakers or give an alarm to indicate the existence of a ground. These units usually employ a relay operated by a grid glow or Thyratron tube, which is in turn operated from a coupler connected across one of the three phases of the high-voltage line.



Westinghouse

One-shot instantaneous reclosing relays for circuit breakers in attended, unattended and supervisory-controlled substations are among the relay developments. In at least one case the design employs a capacitor, charged from a battery circuit, and discharged through the operating coil of the relay to close the relay. On closing, the series holding coil of the relay and the closing relay of the circuit breaker are energized. If the breaker remains closed the capacitor will recharge for another operation. However, if the breaker reopens the capacitor will not have sufficient charge to close the relay again.

An integrating lockout feature has been incorporated in the design of one type of motor-operated multiple recloser. This feature provides protection from excessive breaker duty due to a series of faults spread over a time longer than the resetting time of the relay. Any number of reclosures up to a predetermined maximum are permitted by the unit. After the maximum has been exceeded and the lockout feature has functioned the breaker is automatically taken out of service for any inspection or maintenance that may be necessary. Motor-driven cams in the unit provide initial, immediate or delayed reclosure and several subsequent timed reclosures, with reset if the breaker stays in and lockout if it fails to stay in.

Continuity of service to remote rural substations fed by a tap from a line between two switching stations is insured by new developments in automatic switching controls. Units for this application automatically isolate the station from the faulty section and provide it with power through the unfaulted section. This type of switching centers around a compact unit known as a "capaciformer," which consists of sectionalized condensers in series and a low-voltage transformer network. Three-phase, voltage-operated relays receiving voltage from the capaciformers actuate contactors in the circuit of the motor-operated, air-break switches which open on loss of voltage and close on its restoration.

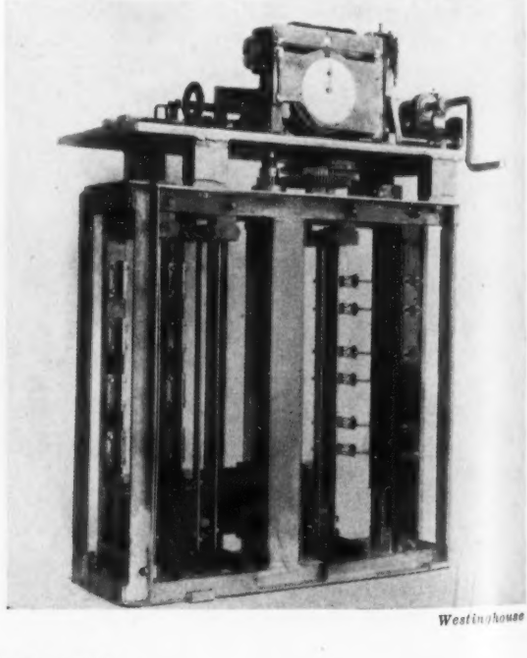
Miscellaneous Equipment—A number of hot-line clamps to be used for the connection of cable to transmission conductors for emergency and lightning arrester taps and temporary grounds have been introduced during the year. The weight of the suspended cable is being used to advantage in some designs to hold the clamp in a favorable operating position. Wire-to-wire contact and extra wide jaws that provide large contact surfaces and prevent breakage of the tap wire are featured in designs for the same service.

Vibration counters have been introduced which can be clamped to transmission line conductors to provide information on the severity of line vibration. Vertical vibrations of any frequency over four cycles per second are registered cumulatively.

New Substation Equipment

General trends in substation design point toward compact, simple, low-cost construction. Manufacturers are following the trend by stressing simplicity, reliability and sturdy construction in their regulator, circuit breaker, switch, relay and station insulator designs. Metal-clad switchgear, unit assembly are being generally used. Miniature controls are being used to reduce the size of switchboards. Changes in tap-changing mechanisms for step-voltage regulators, application of air and oil-blast to station circuit breakers, improvements in switch design, introduction of puncture-proof station-post insulators, development of controls for street light and off-peak service and changes in the design of high-voltage fuses are among the new developments.

General Electric



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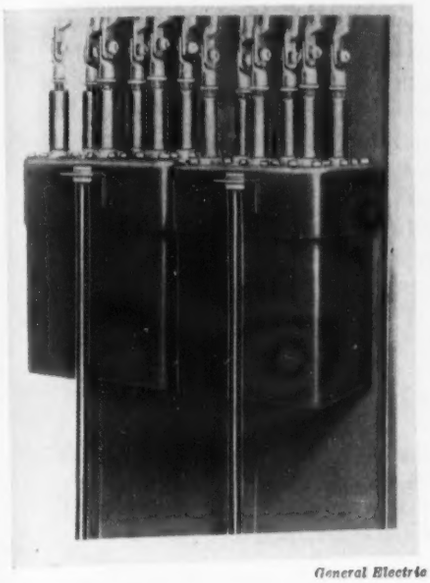

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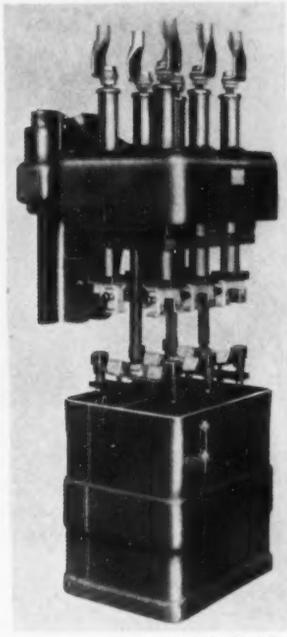

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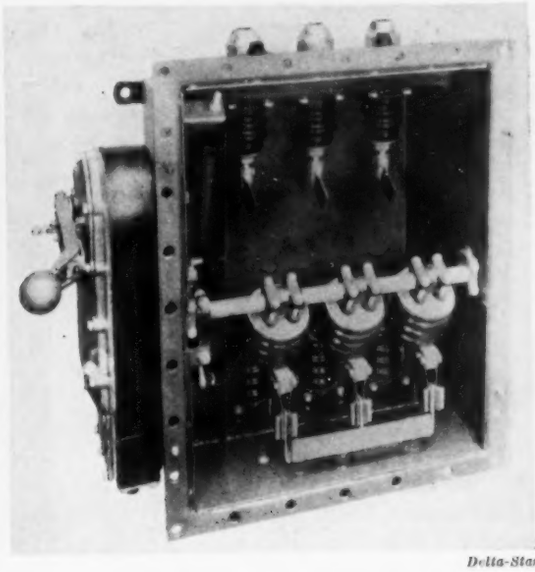
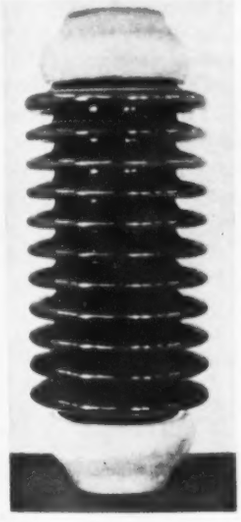
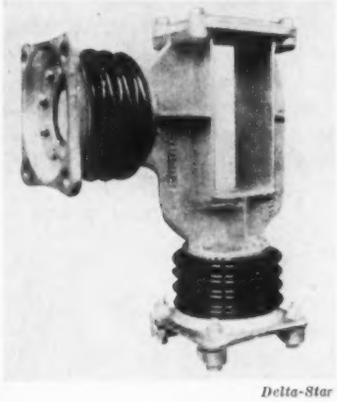


Delta-Star



Lapp Insulator



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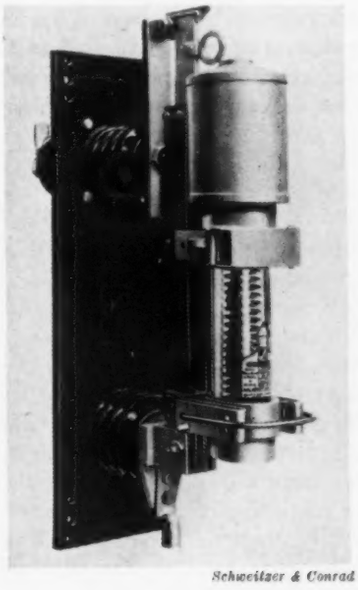
Voltage Regulators—To meet the need for regulators that can be economically applied to low-capacity, low-revenue circuits manufacturers have stressed simplicity and sturdy construction in the newest designs of both step-type and induction regulators.

Design steps have been taken in the further development of step-type regulators to provide tap-changing mechanisms that will facilitate arc extinction at the first current zero and that will prevent the arc restriking while the tap change is being made. One approach to the solution of this problem has been the use of a solidly connected drive so designed that it attains constant speed before the contacts open and, similarly, is not permitted to lose speed until after full contact has been established with the next stationary contact element. Thus current-carrying and arcing contacts are always under full control and mechanical shock of starting and stopping moving elements is largely eliminated.

Switches and Circuit Breakers—Continued improvement and refinement in circuit breaker designs, with the tendency continuing toward space economy, high-speed operation and reliability, is noticed in studying the year's breaker designs. Both air and oil-blast is being employed by breaker manufacturers to decrease operating time and cut space requirements. Designs also feature expulsion ports and high-speed operating mechanisms. Motor-wound, spring-actuated reclosing mechanisms have been introduced by some manufacturers to meet demands for fast reclosing oil-circuit breakers. Heavy current-carrying contacts and silver-to-silver contacts have been used by many designers to insure low resistances and prevent cumulative overheating.

Sturdy construction, generous contact proportions, unit type construction and in-built safety features are common to the newer switch designs. Oil-immersed disconnect switch designs for mounting directly on or in proximity to transformers provide means for sectionalizing from the line. Watertight, oil-immersed disconnects for installation in wet manholes have also been introduced during the year.

Station Insulators and Bus Supports—Station insulator designs are moving toward the attainment of the maximum possible reliability. Protection against puncture and the hazards of cracking from temperature and time



Schweitzer & Conrad

United Electric Controls Corp.

effects, as well as against contamination by atmospheric conditions, has been built into the newer designs. One-piece porcelain post insulators have been developed that are said to promote rigidity and strength by eliminating the need for steel pins and the necessity for providing flexibility for thermal changes between numerous nested parts. Fog-type corrugations are used in this design to provide protection against atmospheric contamination.

For extraordinarily heavy bus runs supports have been made available which utilize two insulated supports at right angles to each other. In this way both vertical and lateral support is given to the bus. Tee connections between tubular buses have been simplified by the introduction of cast-to-form connectors which have a finished cast surface that presents a number of sharp projections that dig into the copper tube conductors to insure permanent non-slip contact.

Station Type Fuses—Maximum reliability on circuits where high-recovery voltages exist has been provided by chemical fuses designed to give maximum mechanical strength and insulation value. Accurate time-current characteristics of the newer designs make them suitable for selective operation. Fuse designs for application where blowing of standard expulsion fuses might cause damage incorporate specially constructed arcing and condensing chambers on the fuse tube.

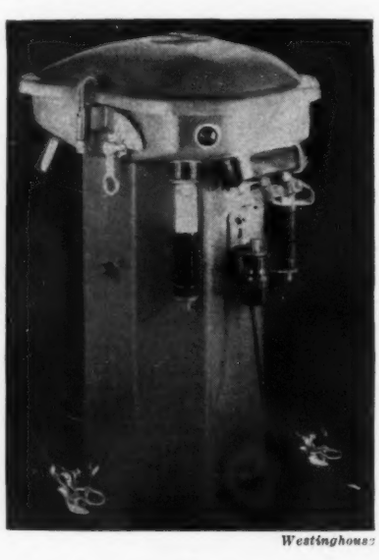
Street Light Control—Developments in mercury-vapor and sodium lamps for street and highway lighting have given added impetus to current tendencies toward the use of multiple street - lighting systems operated through individual transformers from the regular distribution circuits. Problems of control introduced by multiple street-lighting systems have resulted in the development of several relay control systems for this service. At least one of these control systems utilizes direct-current impulses sent out over either distribution neutral or pilot wire from station batteries to actuate polarized relay controllers located at each street light. Polarity of the d.c. impulse determines the position of the relay armature. Application of this type of control system to off-peak load control is also possible.

New Distribution Equipment

Distribution designers are moving toward improved reliability, standardization, better regulation, simplified and sightly pole-top construction, lightning-proof design and higher efficiency. Manufacturers who design equipment for overhead and underground distribution equipment are keeping step with these trends.

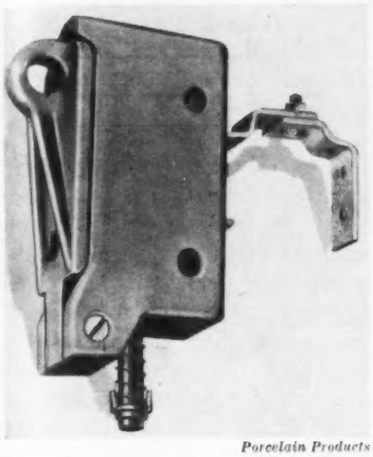
Notable among the year's developments in equipment are: Further advances toward development of a self-protecting transformer which houses its own protection equipment, development of bushing-type lightning arresters for transformers, introduction of improved designs of glass-housed and semi-glass-housed lightning arresters, attempts to foil the rock-throwing public by use of rugged "bullet-proof insulators," introduction of self-lubricating wire guards and improvements in insulated line wire, improved solderless connector designs, the production of fusible secondary cutouts for overhead secondary network systems and the introduction of various multiple connector designs for making simple low-cost secondary junctions in underground distribution systems. All these developments point to an awakened consciousness of the shortcomings in prevalent distribution design and to a healthy attempt to eliminate them.

Distribution Transformers — The past year has been marked by continued improvement and refinement in transformer design. Interconnection of primary and secondary neutrals has become well established and several designers have turned their attention to making the transformer units still more self-contained and self-protecting. Some distribution engineers prefer to use the standard assembly. Fusible links have been installed in primary windings in some designs to prevent feeder outage in the event of internal winding failure; various types of lighting gaps have been developed for use between primary and secondary neutrals, and in at least one case small thermally operated circuit breakers



Westinghouse

Locke Insulator



Porcelain Products

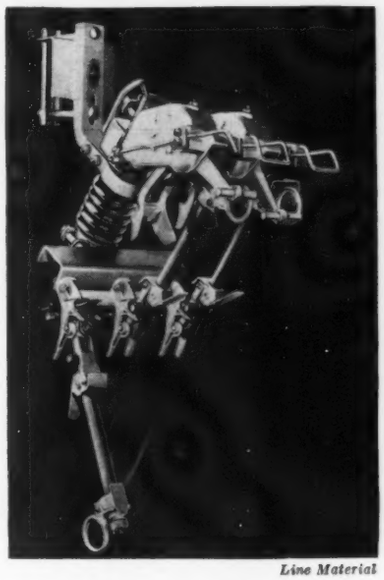
have been used in the secondary winding to warn of excessive temperature rise and to remove the transformer when it is in danger.

Transformer valve-type bushing arresters have been introduced as a means of clearing up pole-top construction and providing lightning protection in the transformer itself. A further trend in transformer design is toward the use of solderless connectors built into secondary bushings. In a few cases clamp type connectors are supplied on the primary leads.

Distribution Insulators — Insulator designers seek a more rugged mechanical construction. This is in an effort to increase distribution reliability and reduce outage due to damaged insulators. Blows hard enough to damage the projections of these new insulators usually leave a heart strong enough to keep the line in service until replacements can be made.

Development in spool type insulators is toward the use of lead bushings to act as a cushion against stresses and to protect the insulating material from contact with the bolt. The added mechanical strength provided by the bushings assures a longer life and lower maintenance cost than was formerly possible.

Overhead Line Conductors—Several insulated line wires have been introduced which cost but little more than weatherproof wire and give greatly increased insurance against short circuits and grounds where wires are closely spaced and exposure is bad. In some instances "self-lubricating" tree guards are being used to solve this problem.



Line Material

Distribution Cutouts—The objective of increased reliability of drop-out indicating mechanisms is to be noted in any study of the year's new fusible cutouts.

To avoid exposing the interior of the disconnect to the weather, most of the newer designs provide for the door to remain closed when the fuse blows. The indicating feature is provided in several ways, but usually by forcing the cartridge through a hole in the bottom of the cutout.

Reclosing cutouts are finding increasing acceptance in an endeavor to reduce service outage and to cut down the cost of re-fusing. In at least one instance adjustable time relay is provided which momentarily delays the reclosing of the circuit after the fuse has blown.

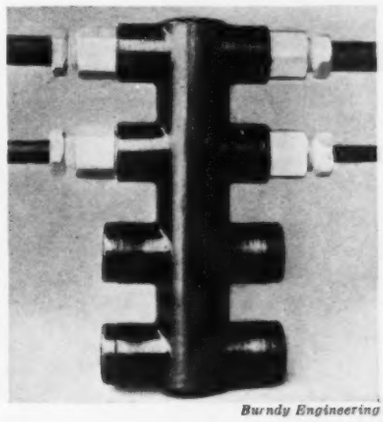
Designs are also available for use where an overhead circuit is to be connected to an underground circuit through fused cutouts. A cable pothead is an integral part of the cutout and facilities are provided for surrounding the space inside the pothead with compound.

Line Material

A number of indicating secondary cutouts have been introduced which use standard fuse links. However, special secondary circuit fuses are available for use with these cutouts when desirable.

Distribution Lightning Arresters—Developments in the technique of molding and glazing glass in different forms have been utilized to advantage by electrical manufacturers who are employing this material in the body structure of distribution lightning arresters. Several designs of glass-housed and partially glass-housed arresters have been introduced during the year. Aside from a pleasing appearance, perhaps the primary advantage of these transparent housings is that the internal structure is made readily visible for inspection. Bushing type arresters in many designs for equipment mounting are available.

Underground Distribution Equipment—To meet the need in underground secondary distribution systems, low-cost service taps and junction boxes a number of insulated multiple connectors have been developed by both distribution engineers and electrical manufacturers. These connectors were developed along with the practice of using non-leaded splices and non-leaded cables on secondary distribution and of using taped service splices on rubber-leaded secondary mains in a.c. distribution conduit lines. Connectors of this type usually consist essentially of a solid copper body over which either rubber or molded insulation is used. Taps are made by either screwing clamps into tubular projections of the body or, in other cases, by using crimped sleeves to join the cable to projections from the body



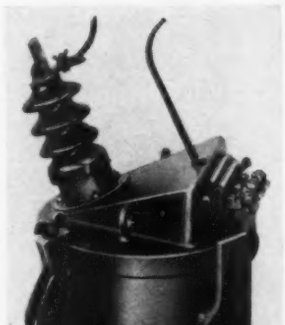
Burndy Engineering

of the connector. Joints are insulated by taping with newly developed materials.

Advances in the design of network cables are continued with the introduction of improved designs. Some of the new leaded cables use a layer of specially treated cloth to cover the conductor and two layers of "Pyranol"-treated asbestos over the cloth. Non-metallic cables were introduced for 600-volt service in oily or alkaline locations where abrasion protection is needed. Ozone-resisting rubbers are coming to supplant older rubber compounds used on primary distribution cables and this is rendering use of potheads unnecessary in some instances; *i.e.*, single-conductor primary riser construction.

Rural Distribution Equipment—Aroused interest in the construction of low-cost rural distribution lines during the past year has been reflected in the development of equipment specially designed for this application. Design emphasis for all classes of equipment has been placed on economy. Accessories have been reduced to a minimum. Excess weight has been pared off. Simplicity has been a watchword in the development of hardware, switches, transformers and protective devices. However, it has been found that standards of reliability cannot be sacrificed in new construction.

Standardization, however, has not progressed far in certain types of equipment. Many different designs of switches, transformers, fuses, hardware



Kuhlman Electric

and relays for this service have been introduced. Lack of standard assembly units used in rural, and to some extent urban, distribution has contributed its part to wide variations in pole-top design. Local conditions largely cause this variation, but do not avert the necessity for more uniformity in materials and supplies. It is probable that the simplification introduced in rural lines may be adopted in regular construction.

Rural Transformers—Single-phase transformers with one primary terminal have been introduced by a number of manufacturers for rural lines where a grounded neutral Y system is employed. Lightning protection by the use of co-ordinating gaps is commonly used with these units, together with stud-type, removable-cover bushings for the primary terminal. In a number of cases the transformer core and windings have been suspended from the cover in such a way that the assembly may be rotated to align the secondary bushings properly with respect to pole or secondary racks, without removing the transformer.

For cases where the grounded neutral Y system is not employed and for the standard Y system on many properties standard two-bushing transformers are used. Usually these transformers feature light weight and low mounting cost. Mounting on a bolt through the pole as an optional construction to the use of hangar irons for crossarm mounting is frequently specified. In some cases companies are following the practice of installing on rural lines the smaller distribution transformers that have been removed from urban service.

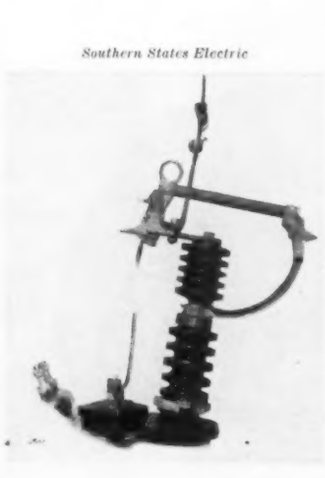
Rural Line Transformer Protectors—Although the new single-bushing transformers often are used without primary fuse protection, many engineers deem it advisable to have some type of economical and efficient protection. This has led to the development of a variety of suspension fuses for direct connection between the primary line and the single bushing of the transformer. For the most part these devices consist of "hot-line" clamps with an attached insulating tube that contains a fuse link. In several cases spring mechanisms are provided to eject the free end of the fuse and to provide a visible indication of fuse operation. These devices can be installed or replaced with a switch stick.

Another type of transformer fuse protective device is mounted horizontally on the single high-tension bushing of rural distribution transformers. When the fuse fails the cartridge swings to a vertical position. By lifting the cartridge off its hinged point it can be re-fused and its flared socket dropped back over the point preparatory to closing and latching in place, with the aid of a switch stick.

Rural Line Hardware—Hardware used on rural lines is similar in most

W. N. Mathews

Tips Tool



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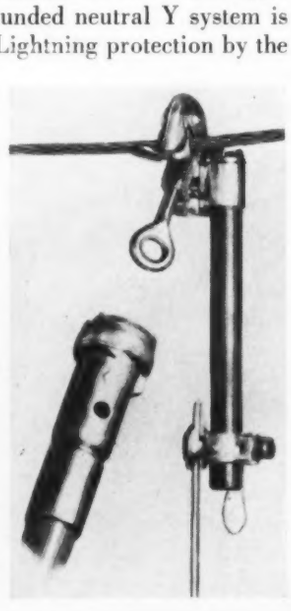


Ohio Brass

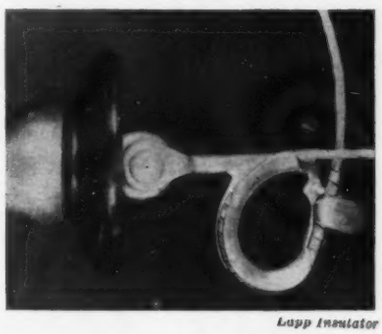
respects to that used on urban lines. A few design changes, however, are to be noted. These, for the most part, tend to make for lighter unit weight and simpler construction.

For angle construction clamps are available which simplify construction and make it possible to turn angles from 30 to 120 deg. without dead-ending conductors and using jumpers. Insulated clevises are widely used when break angles in lines are greater than double ridgepin construction permits. These clevises also find application for dead-ending primary wires and in the smaller sizes for dead-ending secondaries and running neutral wires on the side of the pole.

Replacement of insulators without cutting the jumper and making dead-ends anew has been facilitated by several new types of dead-end clamps and thimbles. These units connect directly into the eye of suspension insulators and dead-ends are made about them without cutting and splicing the wire.

Special clamps are also available to carry neutral wires at tangent points. Through-bolts to support this type clamp also tighten it by drawing a keeper piece down firmly against the conductor. Additional clamps for grounding the neutral at various poles are not necessary since the keeper piece is provided with a groove for taking ground conductors. This clamp is also used for supporting neutral wires at the tops of poles.

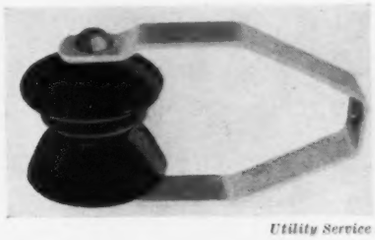
Anchors to meet the range of soil conditions found in rural line construction and having sufficient area to insure proper holding power have been made available by a number of companies. Cone, expanding (two, three and four way), as well as screw anchors have been marketed. Where soil conditions permit its use the screw anchor affords low-cost installation as it is supplied with a special



Lapp Insulator

anchor rod with an eye large enough to take a bar for screwing the anchor into place. Many designs of solderless connectors are available for rural construction.

Rural Conductors and Cables—In general, it may be said that three different types of conductors—ACSR, copper-coated or copper-stranded steel, and copper—are being used on rural lines. As was pointed out in a recent ELECTRICAL WORLD survey (February 29, 1936), conductors other than the



Utility Service

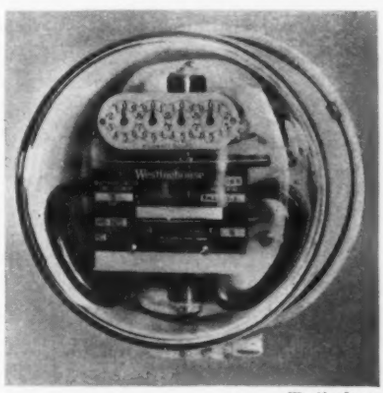
conventional copper and aluminum are already well established in the field. Due to the general use of long spans on rural lines the use of high strength conductors is coming into increasing acceptance.

Insulated cables for underground and aerial installation on rural systems have been placed on the market during the past year. Various designs of cable have been adopted for this application. They include rubber-insulated, varnished-cambric insulated and paper-insulated cable. Both lead sheath and non-metallic (jute) armor are used.

Meters and Service Equipment

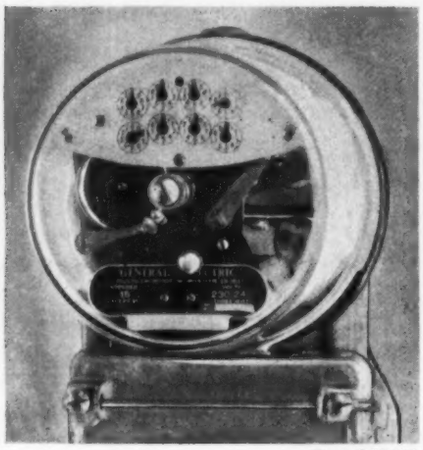
Marked advances in the design of equipment for this class of service have been made during the year. The use of outdoor meter installations has been given added impetus by the introduction of improved designs of weatherproof meter boxes. The problem of preventing current diversion has been solved, in part, by the marketing of equipment to make completely metal-clad meter installations possible for both indoor and outdoor applications. Two-element network watt-hour meters in the same size case as single-phase meters have been introduced, as have combination meters and time switches for metering loads on special off-peak rates.

Meter Developments—Development of a reliable two-element network meter, housed in the same size case as a single-phase meter, has made a compact instrument available for metering energy in three-wire installations and has aided in putting current diversion under control. Features of low-installation cost and interchangeability are said to be realized, since the new designs are to be had in both standard and detachable socket-type mountings. Generally, substitution of the new two-element meters for single-phase, socket-type, detachable meter is possible by making certain simple changes in one of the terminals in the standard socket.



Westinghouse

Widespread use of special rates for off-peak water heating has made the need for combination watt-hour meters and time switches apparent. Until recently such units have not been obtainable. To meet the need meter manufacturers have introduced combination meters and time switches in several forms to meet conditions imposed by



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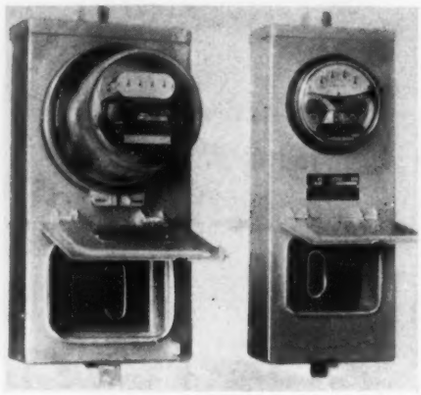

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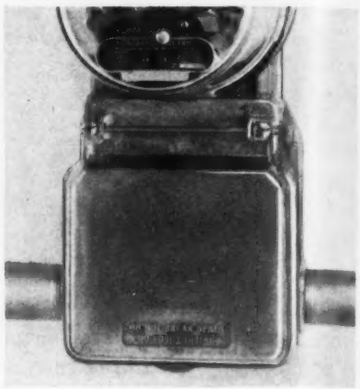
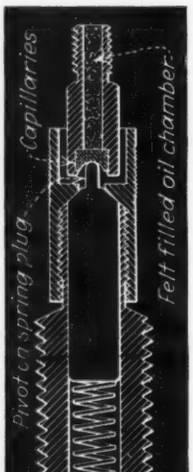


General Electric

different rate structures. Where metering and control of water-heater loads must be separate from the rest of the load single-dial register designs, with contacts are available. For locations served under rates providing no off-peak control, but where the entire load is placed on a different rate during off-peak periods, designs have been developed which use a double-dial register without contacts. Where off-peak load control is desirable, but where the entire load is lumped during off-peak periods, double-dial registers with contacts have been provided.

The aim of the newer meter-bearing designs has been the improvement in meter accuracy through elimination as far as possible of the friction effects introduced by abrasive products coming in contact with meter jewels. Special alloy pivot pins have been introduced by some meter manufacturers. Oil-soaked felt above an inverted jewel has been used by some designers to lubricate the cup of the meter jewel by capillary action. The inverted position of the jewel tends to prevent dust from accumulating on the jewel, thus increasing bearing friction with resulting loss of meter accuracy.

Meter Housings—To prevent current diversion, reduce the number of unread meters each month, provide accessibility for testing meters and to meet requirements imposed by the new metering sequence, manufacturers have been co-operating with public utility meter departments in the development of a number of meter housings whose purpose has been to bring the customers' meter outdoors. This trend has

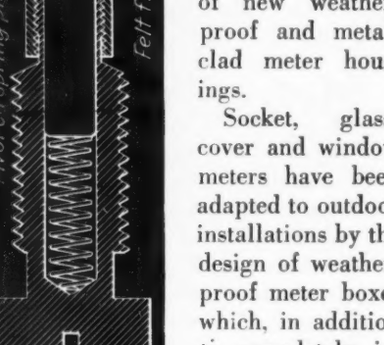


Herman D. Steel

introduced problems of providing weatherproof meter and switch housings, which have been met with the introduction of a variety of new weatherproof and metal-clad meter housings.

Socket, glass-cover and window meters have been adapted to outdoor installations by the design of weatherproof meter boxes which, in addition to completely inclosing the meter and terminals, also houses the customer's main service switch and fuses. Separate sealing arrangements permit access to switches and fuses but prevent access to the wiring chamber.

A connection box, protector case and terminal block are the integral parts of a metal-clad unit which has been developed to provide complete testing facilities and to permit meters to be readily attached and detached. A meter-mounting bracket has been made part of the connection box design to insure correct alignment of the meter and box regardless of the type of surface on which the mounting is being made. Design of the connection blocks permits meters to be tested in place, removed or exchanged without interrupting service.

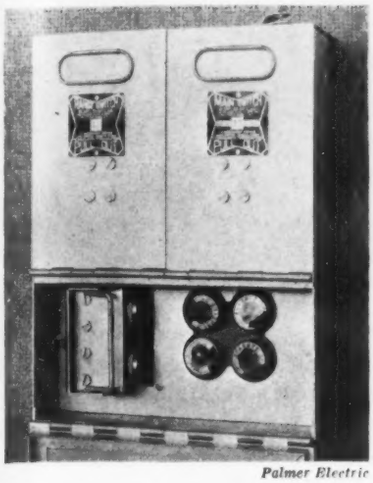


General Electric

Inside Wiring Equipment—A conspicuous trend seems evident toward the use of more adequate wiring for residences and other buildings. Emphasis is being placed on providing local control and protection in each section of the house wiring or the factory wiring.

Systems which employ individual branch feeders emanating from a centrally located main fuse panel and divided into branch sub-circuits radiating from and controlled by a single miniature circuit breaker have been introduced to provide power to the different service outlets. Research continues on new types of inside wiring systems and service-entrance cables.

Main Fuse Panels—Although a number of different designs of panels have been placed on the market during the past year, they differ only in relatively minor details. Essentially they consist of (1) a panel box at the terminal of the service entrance cable, which contains a main fuse block connected to the ungrounded side of the service entrance feeders and to the terminal blocks, from which sub-feeders emanate, and (2) secondary fuse blocks for special power circuits in continuous use such as to electric ranges, air-conditioning equipment,



Palmer Electric

water heaters, lighting circuits and water supply systems.

Miniature Circuit Breakers—Serving as both control switches, governing groups of lighting and convenience outlets and as a means of overload protection for branch sub-circuits served by them, miniature breakers of 15 to 20 amp. capacity on 110-volt circuits have been made available by several manufacturers for application to the modern standardized wiring systems.

In appearance and general dimensions the breakers are very similar to conventional toggle type switches. Generally most designs now available have three operating positions: *up* to close the circuit, *center* to indicate automatic interruption of the circuit due to overload or short circuit, *down* to open the circuit manually. When overload has occurred and the breaker handle is in the center position, service is restored by throwing the switch down and then up to the operating position. Units are arranged for mounting on flush wall panels.

Fuses—To eliminate the trouble of keeping a stock of plug fuses on hand to renew those that have blown to protect wiring circuits from overloads and short circuits, a number of renewable plug fuses have been introduced by equipment manufacturers during the past year.

In some designs mercury has been used as the fusible current carrier. Fuses of this type can be renewed after blowing by removing them from the socket and tapping them point down several times to restore the mercury

Central Vacuum Products

column that has been interrupted by operation of the fuse. Other designs house a number of fuse links in one plug. After operation of the fuse a new link is engaged by turning a knob on the fuse itself, in this way engaging a new link.

Great improvements have been made in the design of standard cartridge fuses. Their rating and operating characteristics are checked by actual performance. Fuse designs are keeping pace with breaker designs.

Extension Wiring Systems — To avoid the mass of inconvenient, unsafe and unsightly extensions now widely used to provide additional outlets in already wired homes electrical manufacturers have introduced schemes in

Square D

order to provide convenience outlets.

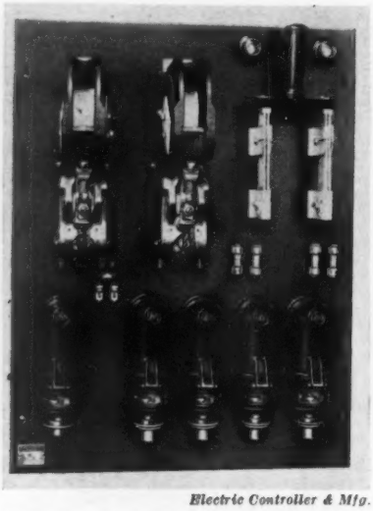
Various approaches to the problem have been made by different manufacturers, but all of the systems revolve around the use of either rubber or metal raceways originating at existing outlets and attached to the wall of the room above the baseboard. Outlets are either provided already built into the raceway or are installed as desired in the raceway.

New Industrial Equipment

Research and development work carried on by electrical manufacturers during depression years is reflected in the equipment now being brought out to provide a degree of flexibility and control of heavy industrial equipment heretofore sought but seldom attained. Sensitive relays, electronic tubes and instruments and controls formerly considered too delicate to stand the "rough and tumble" of high-speed production have now been taken into the fold by industrialists and are being applied to new jobs. Metal-clad switchgear, improved motor starters with in-built overload protection, variable speed motor drives, a multiplicity of accurate and reliable production and test instruments, together with efficient high-temperature-resistance furnaces, heat-treating ovens, furnace controllers and automatic welding equipment are to be noted among the developments in industrial equipment.

Control Equipment—Factory engineers are breaking away from the idea that control equipment for motors and machines must be placed at the driven machine. With the introduction of several unit control centers motor-control push buttons are being located conveniently at the operator's fingertips and the control devices are centered at unit panels in strategic central positions. This makes for wiring flexibility and permits driven machines to be moved about to allow production to flow smoothly. Most units of this type consist of a distribution panelboard and a series of compartments for housing motor starters and contactors.

Controls have been devised to insure automatic operation of stand-by units in the event of failure of electrical equipment in service. A variation of this control may be used to secure equal wear on two similar machines which perform the same duty (one a spare) by making them operate inter-



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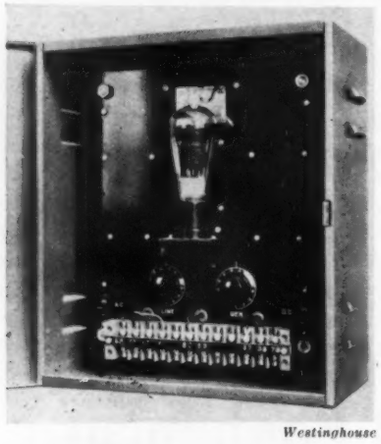

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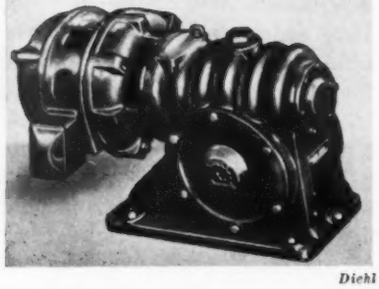
General Electric



Diehl

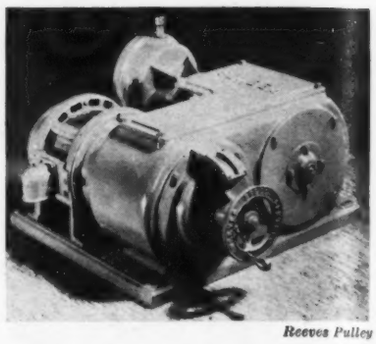
mittently. In this way deterioration arising from non-use is avoided.

In cases where large synchronous motor-driven reciprocating pumps and compressors are in use, light flicker and faulty operation of electrical equipment may result if the compression strokes are allowed to occur together on two or more individually driven machines. Electronic tube devices have been developed to reduce the magnitude of current pulsations arising from this type of operating difficulty.

Need for accurate time control of various modern industrial processes has been met with a number of automatic timers which can be adapted to any time sequence of open and closed circuits over cycles of seconds, minutes or hours. Some control schedules can be adapted to the time of day, while other designs will handle repetitive action requiring a definite time period or cycle with either different or the same periods between successive cycles. Most controls of this type used a series of synchronous motor-driven cams to provide for the opening and closing of electrical circuits in proper relation to each other. Other timing devices use a thermal relay to operate mechanical contactors with a delay of seconds to several minutes. Application of this relay to sequence starting of motors has been found to reduce inrush current and demand loads.

Variable Speed Drives—Manufacturers have devoted considerable attention during the past year to the design of variable speed motors and speed reducers for industrial application. A number of designs have been developed which give infinite speed control from standard constant-speed motors. These designs are, for the most part, mechanical in nature, with speed changes effected by simultaneously varying the diameter of two pulleys mounted on parallel shafts and connected by a belt. Other schemes obtain speed control by varying the position of metal rollers that are in automatically adjusted pressure contact with steel races on input and output shafts of the control unit. In all of the speed control schemes standard constant-speed motors are employed.

Helical, worm and planetary gear



Reeves Pulley

speed reducers have been devised for application to various size motors to give extremely high or extremely low speeds for operation of stokers, agitators, mixers or other equipment.

Switching and Motor-Starting Equipment—Simplicity, reliability and superior automatic overload protection have been attained in the newer motor-starter designs. Interchangeable thermal overload protection relays, multi-break arc interruption and silver alloy contacts are extensively used to provide positive accurate circuit interruption on overload. In the larger magnetic starters either time or current limit acceleration is provided for, together with oil-immersed temperature overload relay protection.

Metal-clad switchgear has been extended within the year to light-weight service, thus permitting its application to industrial plants and office buildings and the like. Units consist of circuit breakers, instrument transformers, disconnecting devices, supporting structure and interlocking elements.

Unit type fuse blocks and multi-break switch mechanisms have been applied to industrial safety switches with a view to obtaining easy maintenance and to insure rapid, effective arc interruption. A number of switch designs have also been adapted to use in explosive industrial atmospheres. In at least one instance departure has been made from conventional switch design by placing the arc-extinguishing structure on the movable blade rather than on the stationary member. The resulting piston action of the stationary contacts when interrupting in the arc chamber tends to evacuate the air in the inclosure, minimize burning and restrict the ionized gas.

Changes have been made in the design of a.c. magnetic contactors to

eliminate hum and chatter caused by uneven meeting of pole faces. Full floating resilient armature construction has been used to obviate this difficulty. Arcs formed in the new contactors are ruptured by forcing them away as the contacts start to separate. In this way the arc is ruptured harmlessly in a narrow path between the arc shields. Other designs use Deïon arc shields to confine the arc so that electrical clearance around a.c. members can be reduced to a minimum.

Instruments—A wide variety of instruments have been made available to production managers to assist them in obtaining accurate information as to the efficiency of operation of industrial equipment.

Compact stroboscopic analyzers provide information on vibration of high-speed rotating and reciprocating apparatus or other equipment having recurrent periodic motions. Highly portable stroboscopic lamps used with these instruments make it possible to measure speeds of gears and spindles that are impossible to reach with mechanical speed counters.

Electric Furnaces and Controls—Recent developments in metallic resistor elements for high-temperature furnace application has produced electric resistance furnaces which can function in the higher temperature ranges around 2,300 deg. F., formerly attained only in arc furnaces. These furnaces use radiant plate and tee construction to give support to the element and to assure a free release of heat.

Current advances in carbon arc furnace design have resulted in improvements in efficiency and the attainment of excellent characteristics in the high-temperature ranges. Automatic controls for rocking furnaces have been achieved which permit furnace operators to predetermine and repeat any rocking cycle that has been found satisfactory both thermally and metallurgically for the metal being melted.

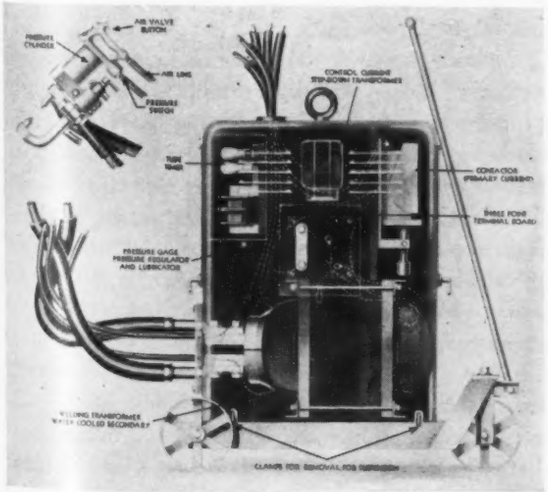
Control of the electrical current input to furnaces, ovens, platens and other electrically heated units have been devised which prevent constant-load furnaces from rising in temperature above a given desired setting. Variations of this type control also permit its application to variable load furnaces to provide proper automatic adjustments with changes in demand.

Welding Equipment—Aroused interest in the industrial possibilities of arc, spot and seam welding as a production tool gives increased significance to the newer designs of equipment for this class of service.

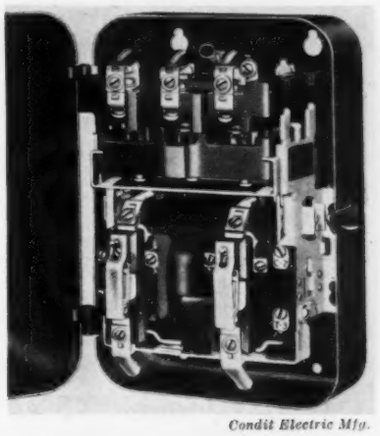
During the year portable spot welders have been introduced which permit application to work too bulky to move or which cannot be reached by stationary machines. A portable welding gun is used which can be carried about at the end of cable extensions which connect it to a mobile cabinet housing all transforming, regulating, contacting and timing apparatus. Automatic control has also been built into the newer designs of single-operated transformer type welders.

Advanced designs of d.c. arc welders have been introduced which employ a new magnetic principle to obtain current control. A magnetic shunt in the armature reaction flux path is used to provide control of the field flux. A generator is obtained which has no shunt field and which requires no field rheostat or control instruments.

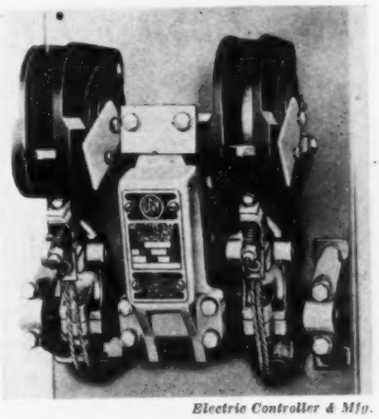
A number of arc welders of established design have been adapted to tractors and trailers to permit them to reach welding jobs not otherwise accessible.



Thompson-Gibb

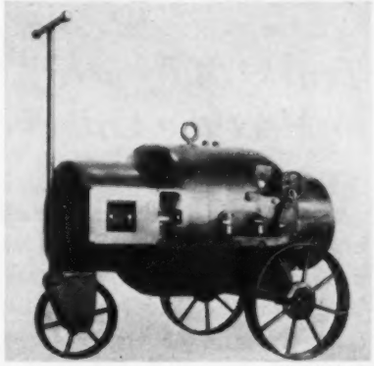


Condit Electric Mfg.



Electric Controller & Mfg.

General Radio



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ELECTRICAL WORLD

L. W. W. MORROW · EDITOR

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Thank the E.E.I. Committees

TODAY as in the old N.E.L.A. days, the work of the several committees of the Edison Electric Institute is vital to the progress of the industry. It is particularly significant, therefore, that the record of committee work this year is outstanding. There has been a revival of interest and increased activity. All meetings have been well attended and live topics have been presented and discussed.

So great has been the interest that some of these committee meetings have been miniature national conventions. They have served as the agency to bring about the interchange of ideas, to focus discussion on operating topics, to make studies and reports and, above all, to educate and humanize the men of the industry. Officials of the E.E.I. will do well to encourage this committee activity. Even more of it is needed and each national committee can well be decentralized to work with local or regional committees.

These committeemen are on the firing line. They are doing the work of the industry in service, sales, engineering and operation. They can develop solutions to industry problems based upon the facts that exist. Their work this year attests their competency and their value to the industry. They deserve the thanks of the industry and more complete executive support in the coming year.

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Trucks Advance to Meet the Call

WHEN floods and tornadoes come, the utility faces emergencies that test the efficacy of its field equipment. Thus, line trucks that may be suitable for normal or even extraordinary tasks of construction are likely to reveal inadequacies that justify outlay to overcome them in the next order. Dependability, safety and versatility are attributes that are always desirable but indispensable in emergencies.

Take the engine. Road mileages are progressively higher, but engine mileage is the crux. Recognition of it is what leads to specifications of rifle-drill, full-pressure lubrication, generous bearings and stellite valve seats. They follow because engine upkeep is 70 per cent of the cost of truck maintenance. A 20,000-pound winch localizes the stresses at the point of attachment to the frame and so the frame must be sturdy and have high fatigue resistance. Traffic conditions demand powered brakes that can stop the full load in the shortest possible distance and hold station when the winch is pulling heavy. Power transmissions are also available for winch operation with the truck moving.

Four-wheel-drive trucks with powerful engines and pneumatic tires are delivering reels of cable practically wherever the caterpillar tractor can do it. The truck has the advantage of travel speed and railroad siding loading. In short, a few years ago truck equipment was special. Today the combinations of features are practically standard and orders can be filled "off the shelf." All these features were brought out by Robert Cass of the White Motor Company recently in addressing the operations section meeting of the Pennsylvania Electric Association.

He touched on the Diesel-engined truck and cautioned against the overstatements about its imminence. While more economical to operate, as far as fuel is concerned, weight and cost of comparable engines will be greater than for gasoline. More skilled maintenance will be demanded. There are a prospective fuel tax, vibration, noise and exhaust smoke problems to consider. Not until these factors have been resolved in favor of the Diesel-powered truck is there likely to be an early place for it in the electric utility field.

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Engineering Condemnation of Government Power Plans

HONOR to Frank F. Fowle, the first engineer of front rank standing who has had the courage to say in public for free publication that the power development program of the United States government is haywire. For a long time engineers have mumbled among themselves about the crass ignoring of common sense in this, that and the other political power project, but until now there has not been a competent engineering appraisal of the whole stupid thing published to the world in terms of public understanding.

Those most worthy, grave and reverend seigniors in the halls of Congress and elsewhere in government who have harangued the nation on the harnessing of rushing water and the carrying of nature's boon over long distances on transmission lines to markets in busy

cities will not like the cold light of reason thrown on their picture. Many engineers know and have known for years what is wrong with the picture. But Frank Fowle is the first to come right out and say that it costs nearly three times as much to transmit energy as electricity on wires as it does to transport it as coal in freight cars.

As for generation, he showed that, using coal where it occurs, which must be done with water power, the steam station can produce electricity at a cost less than two-thirds that of the hydro plant. He asserted the obvious fact that government power undertakings as now conceived can prosper only at the price of destruction of investments already made. He ridiculed the naive assumptions of urgent necessity for parsimonious conservation of fuel resources as reason for throwing money away on water power. He tore down the fair front of pious concern for the welfare of the nation so that all may see the rottenness of politics behind it.

It is to be hoped that engineers who sincerely love their country and respect themselves will follow Frank Fowle through the breach he has made in the wall of timidity and inhibitions that has kept the engineering profession from embroiling itself in "politics." It is to be hoped, for the good of the nation and of mankind at large, that the professional societies of engineers will take courage from this individual example to assert themselves as the force they should be in determining national policies on engineering matters. The conduct of the societies is characterized by apathy, fear and indifference in a situation that is dominated by the basest poltical forces and that cries aloud for the best engineering thought and direction.

Mr. Fowle's masterly appraisal, included with the whole proceedings of the session at which it was presented, will be published by the sponsoring organization, the Western Society of Engineers. Every engineer, every intelligent man, who desires the power resources of this country to be bountifully developed, instead of being politically exploited, should obtain and study this work and then should act on what it will reveal to him.

Our Views on "The Industry Today"

WITH your aid and counsel we present this issue as our report on the electrical industry today. It is our contribution and we hope it serves a constructive purpose. While you are on the firing line we sit in the editorial chair and watch, report and interpret. Your enthusiasm about the industry is our enthusiasm. Your success makes for our success. Our service is measured by how well it meets your needs.

We view you with objective yet friendly eyes. Thus, this report partakes of this constructive objectiveness. We did not attempt to make it a weak or merely flattering commentary on your activities. We put our best thoughts to work to orient current activities in terms of the future. We said, sometimes bluntly, what we thought. This is our conception of effective editorial service.

This year, for the first time since 1930—an abysmal six-year period—we can stroke our editorial beards and peer through our editorial spectacles and smile approvingly at the industry, because it is winning out. It is not only surviving, it is going ahead to prosperity.

By traveling thousands of miles, listening to thousands of friends, reading millions of words and viewing the intimate details of industry operations on hundreds of properties, we know the record of the industry. We know what it has done over the years. We know what it has faced during the depression and still faces. We know the policies and the ideals of you who are on the firing line. And today we are convinced that you are going ahead to a better, bigger and more prosperous future.

This is our one major conclusion as a result of the study and consultation culminating in this issue. The skies are clearing. The industry is ready to meet today's conditions. Some policies of the past have changed, some practices have become obsolete, many personnel changes have occurred, many organizations have been reconstructed. These things were in accord, quite largely, with the realities the industry faces today. The industry of 1936 is no longer the industry of 1930. It has been modernized and rebuilt. It is ready to go ahead. Whether the metamorphosis was desirable or not, it was necessary. It *strengthened* the industry.

THIS intimate report contains a word of advice. That is to develop and maintain teamwork and unity to meet both the problems and the opportunities that lie before you. Let no one divide you in order to destroy you. Take the blows with a smile, but fight back. Believe in the future and put your best efforts into constructive and unified industry up-building. This is a preachment, but we believe it is also wise.

In conclusion, we want to thank each of you for your help, for your suggestions, for your friendly welcome when we visit you. We are only a temporary part of the 62-year service tradition that is incorporated in ELECTRICAL WORLD. We pass on, but the paper continues its tradition of service and quality. It modernizes, as does the industry. We hope that in the future it will continue to reflect "The Industry Today" and receive your friendly support and counsel.

NEWS OF THE WEEK

E.E.I. Engineering Groups Treat Live Problems at Detroit

System Design and Operating Problems Analyzed at Score of Sessions

Problems of electricity system design and operation received a very thorough going-over at the meetings of the E.E.I. engineering committees in Detroit, May 10 to 13 inclusive. This is not to infer that the committees now have all the answers; rather, it is to state that as knowledge of the problems increases the job of solving them becomes more widely imperative. In power cables, for instance, thinner insulation for economy raises dielectric losses and brings into consideration the cost of these losses in capital account and in coal consumed. A feature of the meetings that was considerably more apparent than previously was the manner in which the interests of the various groups were tied together. Here were the accident preventioners invading the meetings of the other committees to tell their safety message to respectful listeners. Here were problems of energy utilization presented by the same men to the different committees interested.

Emergency operations and service restorations in flooded regions were topics discussed in their various aspects according to the specific groups interested. All of which is to say that these meetings in Detroit were far from being whispered discussions of cloistered groups, each in its little cell, as has so often been the case of committee convocations in the past.

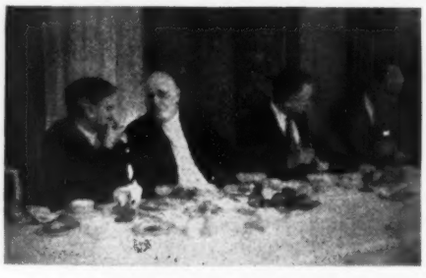
Transmission and distribution

Papers in the two-day sessions of the transmission and distribution committee (P. H. Chase, chairman) dealt with a wide range of facilities and practices—conductors, reclosure of breakers, insulator co-ordination, pine pole treatment, crossarm specifications, wire identification, standardization of transformer bushing dimensions and radio interference as major examples.

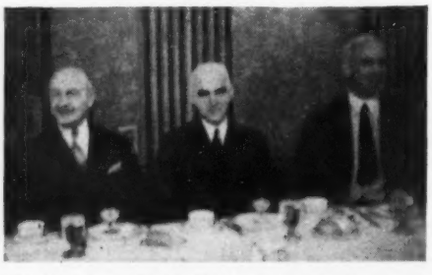
Extensive studies by A. L. Malmstrom of weather records from 1911 show that wind velocities above 50 miles per hour very largely occur when temperatures are above the 40 deg. F. temperature, and thus that the concomitance with ice loading is not what was assumed as a basis for the National Electrical Safety Code. In the Great Lakes area the glaze is usually thin and occurs when wind pressures are below 1.5 lb. per sq.ft.

Recital by E. W. Osterreich of the heroic measures by which Duquesne Light got service restored after the Pittsburgh flood elicited admiration and applause. Forced abandonment of division headquarters from which operating crews worked, unavailability of cable, duct and manhole records and damage to testing equipment were the most vital handicaps in the restoration process. All network equipment was inspected before re-energizing and, except for some equipment inconvenience encountered in the checking, all of it went back into service without difficulty and none had to be repaired. Even where the pressure head of the flood water broke through the inspection plates of older network protectors, they functioned satisfactorily nevertheless. From the transmission and distribution standpoint, the service could have kept rolling along through the flood.

Before Alex Dow Told of Britain's Grid



Stanley Stokes, Alex Dow, Alfred Iddles, J. W. Parker



W. F. Sims, N. R. Gibson, C. F. Merriam

P. H. Chase, Alexander Maxwell, P. W. Thompson

New chart data on the kilowatts per mile to raise conductors in wind to a temperature at which glaze will not form were presented by D. C. Stewart. There are also new data on the currents required to melt the ice.

In the opening paper of a projected series on conductors with metal-protective coatings, C. W. Myer of American Steel & Wire pointed out the difficulties in the electroplating process for galvanized wires and the doubtful efficacy of heat treatment subsequent to the customary hot dip process. Many slides were shown of country-wide stock samples which revealed test and service defects of wire galvanized by these departures from the well-regulated hot-dip process. A. E. Silver called attention to the fact that similar presentations from exponents of these other processes should be heard before proceeding to modify existing specifications.

Adding to the rapid circuit re-energizing discussion reported elsewhere, G. W. Van Antwerp urged that more definite time limits be set for such terminology as extremely rapid reclosure, quick reclosure and instantaneous reclosure. He emphasized the fact that no equipment is commercially available for reconditioning existing breakers to bring the operating time into effective reclosure range. These must be developed on the properties until demand rises to a profitable market for the manufacturers to undertake the provision.

As for insulation co-ordination, J. H. Foote believes it better to compare line

insulators as to arcing distance and leakage path. Studying a large variety of insulators used on all-wood, semi-wood and grounded structure lines, he found some significant departures from accepted ideas. There are apparently no standards by which manufacturers rate and measure either leakage distance or dry arcing distance—from where on the insulator or conductor to where on the pin shank is the question. One of his operating companies applied the Foote data in an "on paper" study and found that nine varieties of insulators could be stocked and serve all the purposes for which 29 were currently being stocked.

Electrical equipment

Presenting the high spots of a program like that of the meetings of the electrical equipment committee, W. F. Sims, chairman, is difficult. It is like trying to discover mountain peaks on the plane surface of a plateau. The whole level is high, but no point rises above the others. The only escape from this dilemma is to treat the matters of discussion in their programmed order and let the reader make his own selections. The first session was restricted to committee members, according to classic custom, when apparatus and system failures are talked over. At this session, following the testimony of the members on oil fire experiences, the committee adopted a revised form for the reporting of such fires by operating companies. Also the necessity for improvement in high-voltage outdoor bushings was strongly brought out by the paper and following discussion on operating experience with and testing of equipment bushings. The remaining sessions were open and attracted large attendances.

The challenge of accident prevention to the design and operating engineer opened the second meeting. This was one of the effective extracurricular presentations of the accident prevention committee mentioned in the report on that group. Then came E. S. Fields with a succinctly stated abstract of operating experience with immediate reclosing circuit breakers. Of principal interest here was the tabulation of re-

J. M. Drabelle, A. E. Grunert, P. W. Thompson

H. S. Fitch, Philip Sporn, Lawrence Bartlett

closures and lockouts on lines from 2.3 to 154 kv., which shows only 41 failures of equipment in 3,679 immediate and subsequent reclosure and lockout operations. Followed now recitals of experiences in the recent floods. F. S. Brown related the Pittsburgh story, emphasizing that not one serious accident occurred in the restoration of service after complete shutdown of electricity supply. H. S. Fitch gave a picture of electric system operating conditions in the western Pennsylvania and neighboring area during high water and right after. His paper was noteworthy in its clear analysis of the emergency conditions and of the organization requirements they impose.

A. H. Sweetnam presented reports from four companies in the New England flooded area. Next came a most interesting description of developments that are being made in Europe in compressed air circuit breakers presented by W. S. Edsall. According to the information he disclosed, these circuit breakers are a very much different breed of cats from the familiar oil circuit breaker of today. The report on foreign practice by A. H. Lawton indicated that engineers in other lands and climes are much interested in developments in the American field and that they are cooperating in the exchange of experience and developments.

H. L. Wallau and J. F. Fairman described the system reserve practices of the Cleveland and New York systems. The major outage in New York last winter gave point to the statement in Mr. Fairman's paper that the reserve generating capacity is taken there to be equal to the three largest units. R. W. Wilbraham reported on developments in rotating machinery and electronic equipment. Philip Sporn described the 40,000-kw. hydrogen-cooled turbo-generator to be installed in the Logan station of the American Gas & Electric Company together with a statement of the engineering and economic reasons for the selection of this equipment in this location. A symposium on generating station bus protection included descriptions of protective means applied in fourteen or fifteen large stations. One would say from listening to these descriptions that the isolation practices that began with phase separation in station design and which now appear in separation of bus section structures may result in a few years in a splendid isolation for all units of a switching scheme.

Efforts to have manufacturers provide a larger margin of overcapacity in shunt capacitors were reported unsuccessful by J. H. Foote. Reasons given are increased cost, reported small trouble with existing installations and belief that the amount of overcapacity requested would still be inadequate for the real cure of difficulties now encountered. Mr. Foote reported also on the work of the E.E.I.-N.E.M.A. joint committee on electric ranges. Much progress has been made toward the solutions of problems relating to voltage rating of ranges, connections and wiring and service and safety features. A considerable amount of standardization of parts and dimensions remains to be done for the reduction of servicing costs.

Like the ghost of Hamlet's father, the subject of 220-volt motors on 208-volt networks refuses to be laid. It popped up again in the discussion of service voltages in the program of the utilization and watt-hour meter division of the equipment committee. Also the plague of high starting currents in domestic appliance and other small motors shows signs of becoming epidemic again. Another bothersome thing that is growing in irritation is current inrush in spot welders. It is desirable from the utility standpoint that current ratings be stated on welder name-plates, but this idea does not appear to be widely accepted by the manufacturers.

Accident prevention

Significant to report regarding the accident prevention committee is the vigorous and competent way in which the chairman, W. A. Buchanan, and other members carried the accident prevention story into the sessions of the other committees. They told how investments made in accident prevention measures earned higher returns than those in physical plant and thus were justified

R. A. Hentz, A. H. Sweetnam H. L. Wallau, A. A. Meyer

A. E. Silver, T. H. Haines, Merrill DeMerit

on economy alone aside from any other considerations. In the committee, matters of discussion included grounding, interlocks and hold-off provisions, low-voltage hazards, public safety and resuscitation from electric shock. On this last point the committee reaffirmed the opinion, stated at a previous meeting, that the Holgar-Neilsen resuscitation method is not so effective as the Schaefer prone-pressure method, which has demonstrated its efficacy in many years of experience. Statistical data prepared and presented in the committee show that although electric utility output has increased considerably in recent years and construction now shows some pick-up, accidents in terms of number, time lost and fatalities are still declining, a result undoubtedly to be attributed to the progress that has been made in accident prevention measures.

Confusion and uncertainty about grounding practices of all kinds should be largely removed by the assembly of fundamental principles which the accident prevention committee jointly with other committees has just set in circulation for final comment. Also announced at the meeting was a report of progress in inducing more effective co-ordination of the E.E.I., A.I.E.E. and other agencies in the field of electrical safety. Considerable realignment of scopes and functions are seen necessary to bring this about.

Office hazards will be surveyed by R. E. Kropp. He will have ready for the next meeting of the committee a report on the lost-time cases arising out of slippery floors and stairways.

Cable session

Improvement in sheath quality, realization of optimum operating temperatures and economic consequences of dielectric losses were the major points brought out in a joint session of the E.E.I. underground group with the A.E.I.C. and I.P.C.E.A. groups. W. A. Del Mar reported on the success of gas pressure cable in London and on the installation details of a 50-kv., three-conductor line in Copenhagen 13 km. long which has a minimum of accessories and requires only about $200 worth of nitrogen to fill the pipe to 200 lb. pressure. G. B. Shanklin pointed out that this country is trailing Europe in the matter of oil-filled mileage, only one-fourth now being in this country. Among recent improvements there have been the provision of a varnished cloth tape which resists solution in the oil, new designs of stop joints and simpler reservoir systems. Del Mar and Wiseman both pointed out that whether gas pressure or "Oil-o-Static" or oil-filled design is used depends essentially on whether ducts already exist in which the latter can be placed.

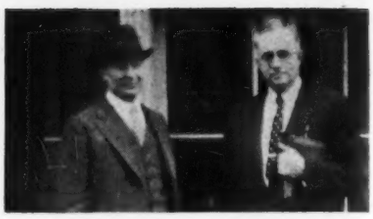
What it has cost manufacturers during the recent lean years to meet the demand for better sheath was convincingly brought out by I. T. Faucett. To keep the oxygen away from the lead and to prevent inclusions has called for new dies at about $10,000 each. One wholly new press entailed an outlay of some $75,000. One manufacturer alone has committed $200,000 to the efforts to meet the utility urgings on sheath, and all told the cable industry has laid out not far from $1,000,000 to make the sheath about twice as good as to bursting life.

That kenotron tests are not wholly effective in catching incipient failures was brought out by H. C. Forbes as a result of New York tests on 54 cables. As for temperature limitations, more at present depends on the sheath of existing cables than on the paper. The index rests more on the temperature range of the operating cycle than on the maximum copper temperature. Startlingly, several stretches of rubber cable interspersed with paper cables went through 130 deg. C. loading without failure, indicating there may be something wrong with the 65 deg. specification for rubber.

Hydraulic power

Figuring importantly in the deliberations of the hydraulic power committee, Carroll F. Merriam, chairman, was the test code for hydraulic prime movers which has been offered in tentative draft by the A.S.M.E. The attitude of the committee was entirely cooperative in the attempt to secure a code so worded that it would be conducive to the best interests of both manufacturers and users. No official action in the matter was taken, but the members were urged to send in their own constructive comments and suggestions to Ely C. Hutchinson, chairman. From the discussion it was quite apparent that the committee, while in general critical of many points in the draft, was not at all of a single mind

Mark Eldredge, H. P. Seelye



W. H. Kelly, D. M. Bunn

as to the points of criticism nor as to the principles to be followed. This state of the committee mind appeared plainly in the discussion of a letter on the proposed code written by the chairman. In addition to three general comments which were discussed, this letter included 23 categorical references to details of the code with suggestions for their improvement.

Dow on British Grid

Alex Dow related his impressions of the design and operation of the British grid at the joint luncheon meeting of all committees. They were generally commendatory, but with the observation that a considerable part of the success of the grid derives from the adoption of American practices. However, he did not forget to remind his hearers that the English are a practical people with their full share of inventiveness and ingenuity and that in some respects American engineers can take profitable lessons from the grid scheme. One thing that makes difficulty for the grid in emergency operations is the division of authority resulting from the separate ownership and control of its elements; that is, generation, transmission and distribution being three different interests. In the matter of production economy this diversity of interest also is troublesome. Summing up his impressions of the grid, he said it was like the little girl "who had a little curl right in the middle of her forehead; when she was good she was very, very good, but when she was bad she was horrid."

Of specific things, Mr. Dow mentioned the experimentation in England to develop a more satisfactory design of self-cleaning, high-voltage insulator, one on which the scouring action of wind and rain would prevent the accumulation of dirt and thus maintain original insulation values. These efforts have not yet been entirely successful except in the production of designs somewhat startling to American eyes. Mr. Dow appeared rather critical of the large use of ironclad switchgear in British practice, showing that he thought that its application over there had gone beyond certain inherent limitations of the ironclad idea, such as the explosion hazard.

Generation

The prime movers committee held closed sessions.

Record N.E.M.A. Spring Meeting

Business good and outlook promising — Unemployment ominous

Received by wire—More than four hundred attended the meeting of the Electrical Manufacturers at Hot Springs, Va., this week. Consensus reports showed good business this year and at least a fair outlook for the future. Most of the sections of N.E.M.A. held individual meetings connected with details of product group operation.

At the policies meeting, President F. C. Jones stressed the fact that one out of three families now depended upon the federal government. In his opinion, this is an ominous situation, at least for the 40,000,000 employed who pay the cost. In addition, it threatens the future of the American system which has produced the high living standards of this country.

Business should start a program for employment as an aid to better conditions. In the opinion of Mr. Jones, business must exercise every care in the future so as to keep men at work and not to expand beyond the normal supply of labor. Production and employment must be better balanced. Labor should support this program, for it tends to stabilize employment and to increase wages.

At this meeting C. E. Swartzbaugh reported on the work of the business development committee. A joint electrical promotion committee has been formed by the four major branches, and in many localities local committees have now been started to co-ordinate their work with the national group plans. The program is to build and expand the market for electrical products and services. This is the basic organization to carry on the work. In addition, progress has been made in contacts with architects, in local electrical leagues and in adequate wiring. Also, some of the sections are undertaking individual promotional activities. Industrial, welding, kitchen modernization are typical examples. A bureau organization of N.E.M.A. proposed and approved at the last meeting is being set up to carry on a co-ordinated program of business development.

An illuminating analysis of what is on the worker's mind today was given by Whiting Williams. He pointed out that the government had recently assumed that worker and employer had opposite interests and had developed its plans as though there was a battleground. Every encouragement had been given to this idea, including collective bargaining, yet the total numbers going into labor organizations did not increase greatly. In the first year of NRA the increase was 700,000 men, but in the second year the increase was only 70,000 men. As pointed out recently by Nolen L. Lewis, only about 3,500,000 out of 33,000,000 workers had accepted A. F. of L. affiliations.

In the opinion of Mr. Williams, the assumption of a battleground is wrong, and in addition, the worker, now as in the past, is an individualist. Despite the pressure put upon the American worker to become a regimented class, he remains and will remain the individualist.

An interesting analysis was presented at another meeting by Thomas McFadden, of trade practice rules from the angle of education and enforcement. Judge Francis E. Neagle commented on the sugar decision of the Supreme Court. All section meetings were well attended and many ladies were present to add to the social values of the meeting.

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Owen D. Young Receives New Honor

"For great services in the cause of improved international good will and in behalf of the principles of good government, and also for unique services toward raising the responsibility of organized business in its relations both to the public and to the state" is the citation which accompanied a gold medal presented to Owen D. Young by the Society of Arts and Sciences last Wednesday in New York City.

At 61, Mr. Young might well be termed America's No. 1 international citizen, contributing his talents to affairs of business and of government, national and international, with a felicity and liberality far too rarely observed in the world today.

His counsel has guided the progress of many of the largest business enterprises, of the foremost educational and eleemosynary institutions and of the most distinguished governmental administrations of our times.

To his own government he has translated the broad policies underlying business, both domestic and foreign; to business he has brought a widened susceptibility of the interests of the people as represented by their governmental agents, and to the repositories of our future social welfare he has borne brilliant, accurate and timely transcriptions of current affairs and the part each may best play in the development of world civilization.

Citations, decorations, degrees and distinguishing appointments are but ammeters and voltmeters which indicate the power and range of a man for whom America may well pause for a moment to bestow the laurel and congratulate itself upon its good fortune in calling him its own.

Rates to Determine E.H.F.A. Activities

The Electric Home and Farm Authority has announced that, hereafter, it will confine its activities to areas where rates for electric service conform to its ideas regarding "maximum" and "accepted" rates.

The following rate levels appear in the announcement:

Maximum Levels

	Urban	Rural
	Pres't Rate*	Pres't Rate*
1st 25 kw.-hr.		
Next 50 kw.-hr.	5c kw.-hr.*	6c kw.-hr.*
Next 150 kw.-hr.	3c kw.-hr.	3.5c kw.-hr.
Over 225 kw.-hr.	1.5c kw.-hr.	2.0c kw.-hr.

*Variation in these prices in applicants' rates is to be expected and will be permitted subject to the limitation that the cost of the first 50 kw.-hr. at applicants' rates shall not exceed $3.25 for urban customers and $5 for rural customers.

Accepted Levels

	Urban	Rural
	Pres't Rate*	Pres't Rate*
1st 25 kw.-hr.		
Next 50 kw.-hr.	3c kw.-hr.	4c kw.-hr.*
Next 150 kw.-hr.	2c kw.-hr.	2.5c kw.-hr.
Over 225 kw.-hr.	1c kw.-hr.†	1.5c kw.-hr.

*Variation in these prices in applicants' rates is to be expected and will be permitted subject to the limitation that the cost of the first 50 kw.-hr. at applicants' rate shall not exceed $2 for urban customers and $3.50 for rural customers.

†This prices contemplates storage water heating, controlled or off-peak, or other similar large use, high-load factor equipment.

Rural rates are based upon a load of three customers per mile of line, it is said. Maximum top rates for the first broad 50-kw.-hr. step are 6½ cents for urban and 10 cents for rural use. Top rates "acceptable" to the E.H.F.A. are 4 cents for urban and 7 cents for rural use.

Risks influenced by rates

"The risk of extending credit for the purchase of electrical appliances is hazardous in areas where rates for domestic service is unduly high," the authority statement says, and, therefore, the policy will be to limit E.H.F.A. financing to "areas served by utilities, public or private, whose rates for domestic electric power do not exceed 'maximum levels' . . . . and whose policy provides for periodic or automatic adjustment in rates as use of electricity increases unless such rates are already as low as or lower than the 'accepted levels'."

The Edison Electric Institute cites this newest incursion into the field of rate regulation as further "proof that the New Deal's birch rod is actually a blackjack.

"Compared with the cost of government, in impairing of the family credit, a penny or two a day off the electric bill is insignificant. . . . The average home is paying only 9 cents a day. The cost of government is now thirteen times the amount of the electric bill."

R.E.A. Allots Another Million

More than 1,000 miles of new rural electric lines in twelve states will be financed with Rural Electrification Administration loans totaling $1,296,400, said Administrator Morris L. Cooke, as he announced allotments for seventeen new projects embracing this mileage. At the same time, he signed loan contracts between R.E.A. and project sponsors on two objects for which allotment of funds had been made previously.

One of the allotments, to a Chippewa County, Wisconsin, co-operative, includes provision for Diesel generating facilities. Negotiations have failed to obtain a reasonable wholesale power rate for this project, it was stated.

With these allotments R.E.A. has lent or earmarked a total of $12,108,412 to construct nearly 11,000 miles of rural power lines serving over 40,000 customers who have never before had central station electric service, the Administrator stated. The funds are distributed among 71 specific projects in 27 states, from coast to coast and from Canada to the Gulf.

The new allotments will be followed by advances of money as soon as legal and engineering requirements are met and loan contracts are signed.

The dispute between the Administrator and the Virginia State Corporation commission as to whether the R.E.A. or the Virginia Electric & Power Company should serve the inhabitants of Doswell moved nearer to a solution Monday when a conference was scheduled between the commission and the R.E.A. Administrator.

While no formal agreement was formulated at the conference, advices to ELECTRICAL WORLD from Richmond indicated that R.E.A. operations in Virginia would be resumed, although no changes were made in the commission's previous order regarding service to residents of the Chancellor section.

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Commission Loses Important Decision

The New York Public Service Commission exceeded its powers in ordering 38 New York public utilities to change accounting systems, Albany advices said Tuesday.

The case came before the New York Court of Appeals on appeal from a decision of the Appellate Division, Third Department, which had found (1) that the commission's orders were confiscatory in so far as they required capital stock expense to be charged against surplus, (2) that the commission's order requiring certain expenses to be placed in a suspense account and not charged to operating expenses was an unwarranted assumption of authority by the commission, (3) that companies could not be compelled to establish a straight-line depreciation charge and (4) that fixed capital accounts need not be altered to show original cost.

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Ickes Hints Sabotage

"I was led to believe there was clever sabotaging within my own organization on power applications," Public Works Administrator Harold L. Ickes testified Tuesday in the District of Columbia Supreme Court.

Unemployment relief was the reason given by the Administrator to justify grants or gifts of 45 per cent of total cost for the construction of power plants which would compete with operating public utility companies for identical customers. News reports from Washington, however, made no mention of present public utility company employees who would beyond doubt be thrown out of work by such duplicate plant construction.

COMING MEETINGS

Pacific Coast Electrical Association—Annual meeting, 245 Market Street, San Francisco, May 28. Victor W. Hartley, managing director-secretary, 601 West Fifth Street, Los Angeles, Calif.

Edison Electric Institute—Annual convention, Municipal Auditorium, St. Louis, Mo., June 1-4. Bernard F. Weadock, managing director, 420 Lexington Avenue, New York.

International Union of Producers and Distributors of Electric Energy—Sixth congress, Scheveningen, Holland, June 10-20.

American Institute of Electrical Engineers—Summer convention, Huntington Hotel, Pasadena, Calif., June 22-26. H. H. Henline, national secretary, 33 West 39th Street, New York.

Society for the Promotion of Engineering Education—Annual meeting, University of Wisconsin, Madison, June 23-26. Dr. F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

Canadian Electrical Association—Annual convention, Murray Bay, Quebec, June 24-26. B. C. Fairchild, secretary, Power Building, Montreal, Que.

American Society for Testing Materials—Annual meeting, Chalfonte-Haddon Hall, Atlantic City, June 29-July 3. R. E. Hess, assistant secretary, 260 South Broad St., Philadelphia, Pa.

Illuminating Engineering Society—Annual convention, Statler Hotel, Buffalo, N. Y., August 31-September 3. A. D. Cameron, general secretary, 29 West 39th Street, New York.

Third World Power Conference—Washington, D. C., September 7-12. Joel Wolfsohn, executive secretary, Interior Building, Washington, D. C.

International Association of Electrical Inspectors — Northwestern section, Olympian Hotel, Olympia, Wash., September 14-16. F. D. Weber, secretary, P. O. Box 70, Portland, Ore.

Association of Iron and Steel Electrical Engineers — Annual convention, Detroit, Mich., September 22-25. Brent Wiley, managing director, Empire Building, Pittsburgh, Pa.

Business to Compete Against Politicians

"The present occupant of the White House is pre-eminent among all men in public life in his ability to think in selling terms and speak in advertising language," Bruce Barton, advertising man, author and editorial writer, told members of the Illinois Manufacturers Association in Chicago last week.

"He thinks in terms of the appeals by which you and I make our products; he appeals to the deep-down motives of men and women; hope, fear, covetousness, envy, the craving for financial benefit and economic security."

The United States he likened to a huge club, then asked:

"The question is, who is going to have the most influence with the 130,000,000 members of the club—the owners of America? For they are the owners, let us make no mistake about that. We and our stockholders are not the owners; we are just men whom the 130,000,000 owners have employed to build them some automobiles, to make them some clothes, to furnish them electric light, to bake them some bread.

"We are ready enough to recognize their importance when it comes to selling them our goods. We flatter them, we beguile them, we seek to lure them by every artifice at our command. We cultivate them as buyers; the politician cultivates them as voters. They have very positive aspirations. They want more comfort, more leisure, more security, a better life. The politician says to them: 'Vote for me and I will give you all those things.' Business says to itself: 'We have created most of the comforts and satisfactions of modern life'—but it does not say this to the 130,000,000 in language they can understand."

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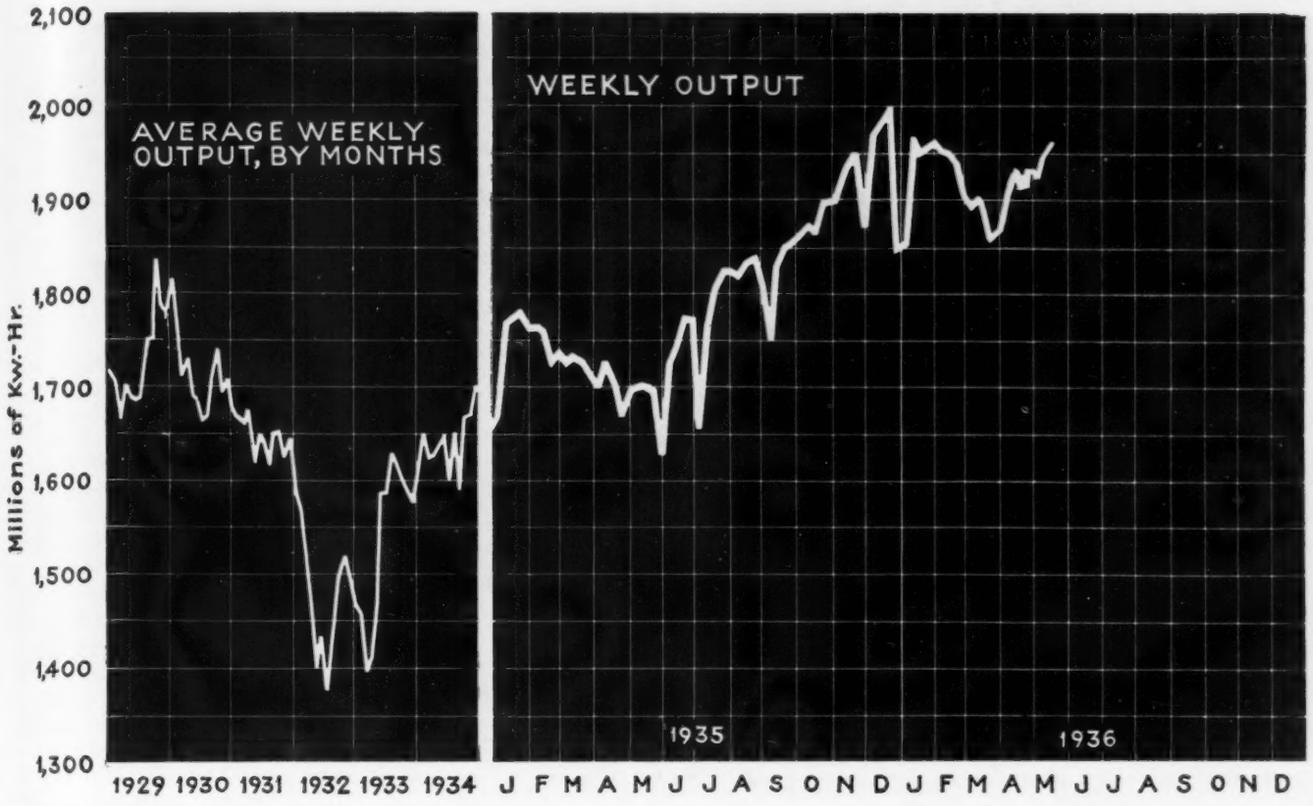
All-Service Buses Oust More Trolleys

Seventy-five additional all-service buses were ordered from General Motors Truck Company last week by Public Service (of New Jersey) Co-ordinated Transport Company to replace trolley cars. This is the second order for all-service buses to be placed this year as 25 all-service buses were ordered in January. The company is converting 30 of its gas-electric buses into all-service vehicles with equipment from the Ohio Brass Company and General Electric Company.

This new development to save utility companies the loss of trolley load was described by A. E. Knowlton, associate editor, in ELECTRICAL WORLD, April 11, 1936 (page 40).

Output Up to Mid-Winter Level



Maintaining the unusual rise of recent weeks and even accelerating its pace, energy production by the electric light and power industry during the week ended May 16 climbed to 1,961,694,000 kw.-hr., according to the Edison Electric Institute. The figure is remarkable in several respects. It is 15.4 per cent above that of the like period a year ago, when production was hovering around the all-time records for this season. It virtually matches the last week in January and closely approaches that month's maximum, recorded a fortnight before. At a time of year when production is normally in the waning phase, it marks a continuation of the upward trend that has been evident for more than two months, barring the interruption caused by the widespread floods during the last two weeks in March.

The gains over 1935 were general, ranging from 11.6 per cent in New England to 20 per cent in the Rocky Mountain states. Gains in the Central states approached 17 per cent.

Per Cent Change from Previous Year

Region	Week ended May 16	May 9	May 2
New England	+11.6	+13.3	+ 9.7
Middle Atlantic	+13.4	+12.1	+ 9.7
Central Industrial	+16.9	+14.5	+14.4
West Central	+16.6	+16.3	+14.3
Southern States	+15.3	+16.0	+15.0
Rocky Mountain	+20.0	+21.8	+22.1
Pacific Coast	+16.2	+15.6	+17.6
United States	+15.4	+14.5	+13.6

Weekly Output, Millions of Kw.-Hr.

1936	1935	1934
May 16...1,962	May 18...1,700	May 19...1,650
May 9...1,948	May 11...1,702	May 12...1,643
May 2...1,929	May 4...1,698	May 5...1,633
Apr. 25...1,933	Apr. 27...1,673	Apr. 28...1,669
Apr. 18...1,915	Apr. 20...1,702	Apr. 21...1,673
Apr. 11...1,934	Apr. 13...1,725	Apr. 14...1,642
Apr. 4...1,916	Apr. 6...1,700	Apr. 7...1,617

Lilienthal Confirmed as Director of T.V.A.

The Senate confirmed on May 18 David E. Lilienthal of Wisconsin for a nine-year term as director of the Tennessee Valley Authority. Request for immediate confirmation was made by Senator George W. Norris of Nebraska, with the explanation that Mr. Lilienthal's term expired on that day. Confirmation was made without objecion.

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Plans for $500,000 Plant

Tentative plans for the construction of a new $500,000 power plant by the Virginia Public Service Company at Alexandria have been announced. The new plant will comprise the latest equipment for the elimination of cinders and dust and its operation will be virtually smokeless. The existing plant will be maintained for standby operation.

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Wisconsin Utility Files $25,000,000 Loan

Wisconsin Public Service Corporation has filed a registration statement under the Securities Act of 1933, covering $25,000,000 of first mortgage bonds, 4 per cent series, due 1961, the net proceeds from the sale of which, with other funds, will be used to redeem in July and August all of the corporation's funded debt now outstanding, bonds of the Wisconsin Public Service Company, Wisconsin Valley Electric Company and Wisconsin Valley Power Company.

Interest on the bonds to be redeemed will be paid by the corporation, it was stated.

New York Metal Prices

	May 13, 1936 Cents per Pound	May 20, 1936 Cents per Pound
Copper electrolytic	9.50*	9.50*
Lead, Am. S. & R. price	4.60	4.60
Antimony	12.75	12.375
Nickel ingot	35.00	35.00
Zinc spot	5.275	5.275
Tin Straits	47.00	45.90
Aluminum, 99 per cent	19—21	19—21

*Delivered Connecticut Valley.

Field Reports on Business

Reports to ELECTRICAL WORLD *from the field indicate that business has stubbornly refused to recede more than very slightly, even though the "topping off" process indicative of a summer decline has been apparent for several weeks. Steel production this week recorded an unexpected, though small, advance and the electric energy output report revealed another advance of surprising proportions.*

PACIFIC COAST

Despite adverse general factors, such as discredited agricultural legislation and special one-day relief session of the Legislature, electrical business is good everywhere in the state in all branches. Outstanding business to be placed covers twelve pumping outfits for Los Angeles metropolitan water project, totaling $1,500,000. This area also reports an equal amount in reconditioned school jobs, of which about one-third is ready for award.

Wholesalers report excellent business, but find tendency to purchase smaller job amounts, principally because of prevalence of smaller residential work, though certain large jobs, such as the San Francisco Mint, are almost ready for material. Staple articles have therefore been repriced with coil or carton securing same prices as former case or package. Manufacturers report good steady sales of standard stock motor and transformer sizes, with a few larger outfits, such as a $20,000 dredger equipment and two motor-generator 1,000-amp. welding sets. Hollywood reports $500,000 of new film plant construction, another reviving branch of electrical business. Power company business is very good, but apparently is a cumulation of steady regular demand.

NEW ENGLAND

In view of a lull in buying heavy power equipment and some hesitation by utility companies in placing orders for new electrical apparatus, the volume of orders for electrical supplies placed in this district during the past week is surprisingly high. Inquiries for small motors are very numerous, according to one nationally known manufacturer, and orders for May to date show no slackening over that reported for April. Another well-known manufacturer reports steady demands for single motors; switch and control apparatus sales are strong and ahead of last year in volume to date. Machine manufacturers are buying small motors and individual drive installations are reported in one well-known shop where a group of small motors was recently bought.

Central station supplies are quiet, but line materials are moving in fair volume; one jobber reports orders for pole line hardware during the past week; poles are being bought by one utility for replacement locally; wire and armored cable sales are better than at this time last year according to one distributor. Service station lighting supplies were recently purchased by a prominent oil distribution company; and a manufacturer of reflector units reports an encouraging tone in buying this equipment and considerable activity in negotiations. Merchandising continues brisk; range sales are making notable advances in Vermont, where 177 have been sold this year by a group of central stations, and in Massachusetts, 40 were recently bought from a well-known utility company. Refrigerator sales are strong; according to one prominent supply company, sales for the present month are likely to reach a peak level for this company to date; in Vermont, 179 were sold last week. Contractors' supplies are quite active and wiring contracts are numerous. One group of Massachusetts electric companies plans to spend about $1,000,000 in capital additions to their distributing and transmission systems.

NEW YORK

Midsummer drowsiness has threatened to grip business for several weeks, but so far has made so little headway that the second quarter promises to be the best of the recovery period. In fact, the incipient decline in several fields which appeared on the horizon about three weeks ago has failed to develop into anything resembling a trend.

One of the strongest spots in the picture is electric energy output, which has scored a second weekly rise of large proportions, reaching 1,961,694,000 kw.-hr., and has increased its margin over 1935 to 15.4 per cent, against 14.5 a week earlier and 13.6 a fortnight before. Steel operations, too, scored an unexpected gain this week, rail car loadings are at or near a new high for the year, retail trade has improved and Washington developments are distinctly more comforting than at the start of the month.

Price cutting in a few industries and a somewhat unsatisfactory statistical situation in petroleum are among the few dark clouds.

CHICAGO

Despite minor recessions in business activity there seems no indication of any important reversal. The recovery movement continued as a whole and remains at a level slightly under the peak of the spring advance. The warm weather brought an immediate expansion in retail trade, resulting in a gain of 23 per cent over the preceding week.

Prominent in central-station activity was the Commonwealth Edison Company's announcement of a plan to spend $3,000,000 modernizing its Fisk Street station. Improvements to be made include two new boilers and a 30,000-kw. turbine. Another modernization program reported includes the installation of an entire new set of elevators. With the best year in its history behind it, a prominent radio manufacturer reports sufficient orders for new models to operate its enlarged plant for two months. A contract was awarded on a job requiring 50,000 feet of covered wire. An order for traffic signal control equipment will be placed shortly. Substantial gains have been registered in sales of lighting equipment, store and office modernization being responsible for a large part of the increase.

Construction has started on a large factory which will be windowless and completely air conditioned. Residential building has apparently reached its stride toward normalcy as figures just released show a volume four times as great as last year.

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Refunding Features 1936 Financing

Electric light and power companies during the first four months of the current year issued new securities to the amount of $458,067,828, compared with $161,286,300 for the similar period of 1935.

Refunding operations predominated in the new financing, contributing $451,508,977 to the four-month total, leaving only $6,558,851 for new capital demands.

Individual issues were for the most part in the form of mortgage bonds, but there were several sizable offerings of notes and debentures, notably the two $35,000,000 debenture issues of the Consolidated Edison Company of New York issued in April. One stock issue appeared —the 4½ cumulative preferred issue of the Central Illinois Light Company, amounting to $11,369,328.

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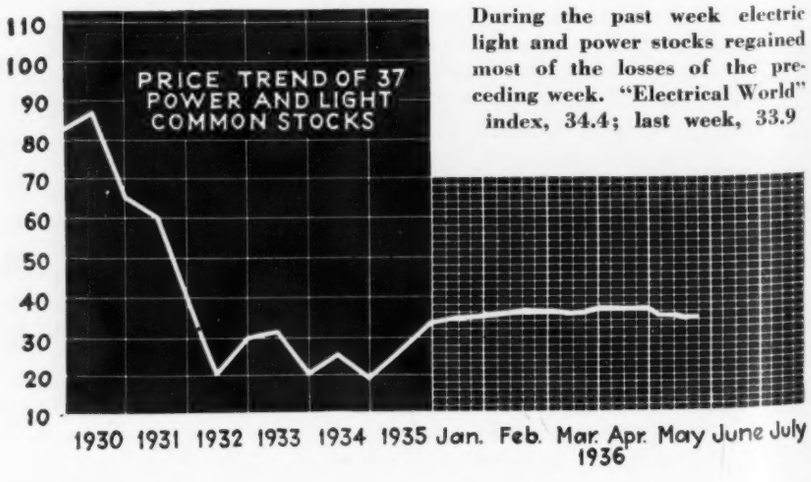
Duke Power Review Granted

In an order handed down this week the U. S. Supreme Court granted a review in October to the Duke Power Company against the publicly owned hydro-electric plant at Buzzard Roost, S. C.

Light and Power Stocks Advance



During the past week electric light and power stocks regained most of the losses of the preceding week. "Electrical World" index, 34.4; last week, 33.9

MANUFACTURING AND MARKETS

Five Steps to Bigger Profits

Five manufacturers and distributors cooperate in issuing a sales stimulator of unusual appeal

"Five steps to bigger profits" is the invitation on the cover of an attractive summery brochure issued by Maxon, Inc., Rex Cole, Inc., General Electric Company, Frigidaire Corporation (Air-Conditioning Division) and Westinghouse Electric & Manufacturing Company. With a minimum of words and a maximum of pictures the booklet describes in practical detail the specific steps to be taken to get sales rung up on the commercial customers' cash registers:

Step Number One: "Show 'em you're in business." A page of pictures of new electric signs.

Step Number Two: "Stop 'em in three seconds. You have three seconds to make an impression," the reader is warned. "Do it with modern window lighting."

Step Number Three: "Bring 'em in with windows that say 'Come in and Buy'" is three pages of window lighting pictures, before and after, good lighting and poor lighting, windows that are excellent reflectors of passing scenes compared to windows that sell passers-by.

Step Number Four: "Keep 'em in with easy-seeing light." This is fifteen pages of information, mainly pictures, regarding the important part played in the modern store by lighting, air conditioning, cooking, refrigeration, water cooling, beer cooling.

Step Number Five: "Sell 'em. Make it easy for them to buy. Help them," concludes the manufacturers' package of sales helps "to see easily, shop in comfort, appreciate your good service, be proud to shop in your store, and you will build bigger profits."

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Refrigerator Sales Up

Sales increases of 51 per cent for the Leonard Refrigerator Company and 30 per cent for the Kelvinator Corporation for the past seven months were announced last week. The Kelvinator Corporation reported April refrigerator shipments at 25,610 units, bringing the total shipments for the seven months to 119,667, compared with 92,041 units in the corresponding period last year. April unit shipments of the Leonard organization numbered 6,939, bringing the total for the seven fiscal months' period ended April 30 to 40,891, compared with 26,999 for the corresponding period last year.

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Electric Cooking Increases in 1936

More and more New York State housewives are making electricity do a part of their work for them while they develop leisure for other interests, according to a survey of the use of major electrical appliances, made public by the Niagara Hudson System.

Sales of electric ranges in territory served by the system were five times as great in the three months up to April 1, 1936, as in the corresponding three months last year. Installations throughout the system totaled more than 1,400 electric ranges in the first three months of 1936 and about 280 in the corresponding period last year. According to the announcement made by the Niagara Hudson Power Corporation the electric range has made the greatest progress of the appliances in the housewife's affections. As one of the newer innovations in electrical service in the home, it has had to prove its value to the housewife.

Another important factor in the increased use of electric cooking has been the rural electrification program of the system. The sale of refrigerators by dealers in the same period increased to about 5,650 over the previous record of 3,460 established for the same period last year.

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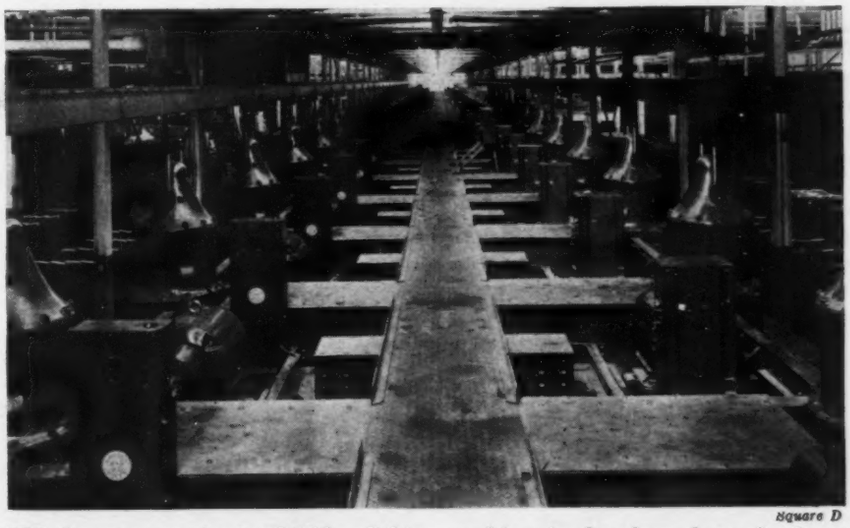
Owens Glass Maps $12,500,000 Outlay

In a registration statement filed under the Securities Act of 1933 for issuance of 63,300 common shares, $25 par value, the Owens-Illinois Glass Company of Toledo stated that, subject to modifications due to changing conditions, it and its subsidiaries contemplated engaging within two or three years in a $12,500,000 program of expansion and improvement of existing facilities.

Unless modified, expenditures for the program would be approximately as follows: Improvement to the Streator, Ill., container plant, $2,500,000; improvement of other such plants of the company, $2,500,000; expansion of facilities of company for production of industrial materials, such as glass blocks and glass fiber, $2,000,000; construction of new container plant at Oakland, Calif., by Owens-Illinois Pacific Coast Company, a subsidiary, $2,500,000; expansion of facilities for the manufacture of thin blown tumblers and stemware and glassware by Libby Glass Company, subsidiary, $1,000,000; expanding facilities by Owens-Illinois Glass Company, $2,000,000.

The shares are to be offered for sub-

6,600 HP. AT WORK POLISHING AUTOMOBILE GLASS



Square D

This long perspective is of 165 polishing machines in the glass plant of a large automobile company. Each one of these machines is driven by a 40-hp. motor equipped with automatic starter with remote control and low voltage and thermal overload protection. The glass plates move on continuous conveyors under the vertical polishing heads, whose tops, like minarets, dominate the picture.

scription pro rata to shareholders of the company at $100 a share in the ratio of one share for each twenty shares held of record at the close of business on June 5.

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House Wiring Plan in New Orleans

A promotional campaign featuring installment payments for household wiring and for the purchase of electrical fixtures will be tried out by electrical contractors in New Orleans for a period of sixty days starting July 1, the National Electrical Manufacturers Association has announced.

It is believed to be the first campaign of its type run by a cooperating group of contractors, electrical goods manufacturers, dealers and jobbers. Local advertising campaigns to acquaint consumers with details of the offer will break late next month.

Under the plan contracts will be accepted on a deferred basis with payments spaced over periods of twelve to twenty-four months.

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Hyatt Signs Pact With Public Service

Contracts have been signed by the Hyatt Roller Bearing Company, subsidiary of General Motors, and Public Service Electric & Gas Company whereby the Hyatt plant in Harrison will abandon its electric generating plant and use Public Service power. This is among the largest of the power contracts obtained by Public Service in recent years.

The connected load will amount to 7,500 hp. and it is estimated that consumption of electricity will exceed 1,000,000 kw. hr. per month. The boilers, steam turbines and other generating equipment at Hyatt's own power plant will be dismantled after Public Service energy is made available.

The decision to purchase Public Service electricity was the result of a thorough investigation by General Motors engineers which showed that it was an economical move to make the change to Public Service central-station power. It is anticipated that the service change-over will be made about June 1.

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Vancouver Plans Jubilee

Advice on lighting Vancouver's golden jubilee celebration this summer will be rendered by General Electric's experts who put over the big electric displays for both Chicago and San Diego, local lighting companies combining to get the western Canada city this service.

Contractors Group Formed in Carolina

Organization of the Carolinas' Association of Electrical Contractors was effected at a meeting held in Charlotte, N. C., on May 4. Objectives of the association, as outlined by R. H. Bouligny of Charlotte, treasurer, are to promote the interest of members, to increase the use of their products and services, to improve the conditions under which the industry is carried on by developing co-operation of all branches, to develop fair and just competitive methods, to perfect machinery for peaceful settlement of disputes, to protect the industry against unfair and unjust burdens and exactions, and to collect and disseminate pertinent data relating to the industry.

John P. Lucas, vice-president of the Duke Power Company, discussed the plan of the association for co-operation of contractors with the utilities companies and wholesale dealers.

J. A. Johnson of Winston-Salem was named president; Dupont Guerry, Jr., of Greenville, S. C., vice-president; E. R. Edman of Winston-Salem, secretary; R. H. Bouligny of Charlotte, treasurer, and C. S. Boger of Charlotte, executive secretary.

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G. E. Paid Pensions to 3,290

Pension payments to retired employees of the General Electric Company for 1935 were $2,598,953, according to the annual report of the company's pension board. The number of individuals receiving pensions on December 31, 1935, was 3,290, one less than for 1934.

The average pension age for the year was 67.6 years and the average continuous service was 29.5 years. The average amount of the annual pension was $771. Since establishment of the pension plan in 1912 a total of $15,630,719 has been disbursed.

•

General Household Retains Trundle Engineering

General Household Utilities Company, Chicago, manufacturer of the Grunow refrigerator and radio, has retained the Trundle Engineering Company, Cleveland, as management engineer in connection with the operation of its plants at Chicago and Marion, Ind., company officials announced last week. The Trundle staff will take an active part in the production, budgeting, engineering and general operations of the company, according to George T. Trundle, Jr., president.

"With three highly up-to-date plants and widespread acceptance for its products over the past three years, the company is now making money," Mr. Trundle said. "Right now it is producing from ten to twelve thousand refrigerators a month in the two Chicago plants and the new Grunow household and automobile radios, which are being made at the Indiana plant, will be introduced in June."

•

Baltimore Adds 35,593 New Net Hp.

The net total of new electric load contracted for with the Consolidated Gas, Electric Light & Power Company of Baltimore during 1935 amounted to 35,593 hp., the company has announced. This addition was the largest in any year since 1930, when 36,106 hp. went on the lines. Of this impressive total in 1935 more than half the new load resulted from the displacement of private power plants. This displacement proceeded at a rate almost double (81.8 per cent increase) that of last year.

Several of the change-overs were notable, the company states, in cases where customers traditionally believed in generating their own electric power.

The company finds that one of the first steps being taken with improving business conditions is the application of purchased complete central-station electric service in order to save the customer money and considerably improve his operations.

•

New Marketing Service

"Electric Marketing Service" has been established under the management of Samuel D. Fitzsimmons in Providence, R. I., to further the advertising and co-operative promotion within the electrical industry of all classes of domestic appliances. Mr. Fitzsimmons was formerly vice-president in charge of sales for the Narragansett Electric Company, Providence, and has established this new service to facilitate a more rapid development of the market for household appliances than has marked much previous promotional work in this field.

•

Sylvester in Charge of Kelvinator Publicity

Appointment of Elmer L. Sylvester as head of the newly formed department of public relations is announced by the Kelvinator Corporation. The new department is to have the same status as other departments of the company. Mr. Sylvester comes to Kelvinator with a background of fourteen years electrical manufacturing and engineering experience with General Electric, United Gas Improvement and General Motors.

INCREASED LOAD BUILDING

follows every "New American" Home

Nation-Wide Program Benefits Entire Electrical Industry

JUDGED by the success of the 1935 "NEW AMERICAN" Home, this year's program will add more than two million kilowatt hours to the annual load!

We say this because:

"NEW AMERICAN" is making communities all over the country conscious of home electrification. It is educating people to the electrical pattern for better living.

It is selling them the advantages of complete electric kitchens and laundries; the convenience of air conditioning; automatic heat; adequate wiring and outlets; and improved facilities for using all modern electrical home devices.

"NEW AMERICAN" is helping to expand electrical consumption from the present average of 678 kilowatt hours per home to 3000 kilowatt hours—the "NEW AMERICAN" Home average.

Last year over four million people visited the 315 "NEW AMERICAN" Homes sponsored by General Electric. And everywhere increased sales of electrical equipment followed.

To you in the utility field, the 1936 "NEW AMERICAN" Home means the biggest residential load building opportunity ever offered. It is a movement that benefits the entire electrical industry.

General Electric local representatives welcome your cooperation in this great load-building program. Your nearest G-E sales office, distributor or dealer will be glad to give you full details.

GENERAL ELECTRIC

If it's General Electric-equipped, it's "NEW AMERICAN"

Architect—Wooster Bard Field
Columbus, Ohio

Architects—Home Crafters Service
Yonkers, N. Y.

Architects—Walker & Gillette
New York

RESEARCH KEEPS GENERAL ELECTRIC YEARS AHEAD!

MEN OF THE INDUSTRY

Personnel Rearrangements in Commonwealth Edison

Changes in organization effective on May 1, resulting from the consolidation of the construction and street departments of the Commonwealth Edison Company, Chicago, were recently announced by A. G. deClercq, vice-president in charge of service and construction. The combined group will be known as the construction department and the name street department will be abolished.

C. A. Lambert, formerly assistant construction engineer, was appointed superintendent of construction and A. P. Thoms, formerly superintendent of the street department, was named assistant superintendent of construction. I. L. Wise, formerly construction engineer of the mechanical division, will report directly to Vice-President deClercq for special assignments.

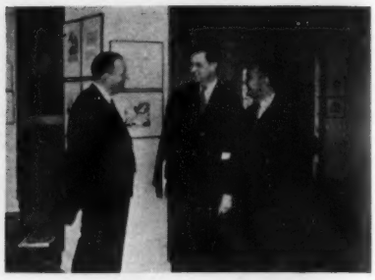
Mr. Lambert started with the company in 1906 as an inspector in the engineering department. He was made chief clerk and inspector in 1913 and was appointed building superintendent of the construction department in 1924. Mr. Lambert became superintendent of the building and mechanical division in 1926 and was promoted to assistant construction engineer in 1927.

Mr. Thoms' company career began in 1902 as a substation operator. He transferred to the load dispatcher's office two years, later, became chief load dispatcher in 1909 and superintendent of the cable division in 1911. Mr. Thoms was appointed assistant superintendent of the street department in 1915, first assistant superintendent in 1929 and superintendent in 1933. He is a fellow of the American Institute of Electrical Engineers and a member of the Western Society of Engineers.

The detailed organization of the construction department as announced by Mr. Lambert will consist of the following groups: Overhead division, station electrical division, tool and equipment division, underground division, composed of the cable section and conduit section; structural and mechanical division, composed of the structural section and mechanical section; safety and training division, and clerical division.

WESTINGHOUSE MAKES RURAL PLANS

G. A. Sawin, manager rural electrification department for Westinghouse Electric & Manufacturing Company, is discussing with his men the plans for the newly formed department. Shown left to right are B. P. Hess, R. L. Pleak, G. A. Sawin and S. M. Marshall. Mr. Hess and Mr. Pleak are field men for the eastern and western sections respectively. Mr. Marshall will co-ordinate their work with the various departments at headquarters. The services of this department are available for use by any central station, municipal plant, rural cooperatives or others interested in the promotion of rural electric service.



J. W. Talley, secretary of the Southeastern Electric Exchange tells a pretty good one at Charleston to Vice-President L. R. Payne (left) of Virginia Public Service and Lawrence Jennings (right) of G.E. Refrigeration Division

▶ PROF. V. G. SMITH, electrical engineering department, University of Toronto, was elected chairman of the Toronto section of the American Institute of Electrical Engineers at the recent annual meeting for the 1936-37 season.

▶ H. J. ROBERTSON, JR., formerly vice-president in charge of sales for the Fibre Conduit Company, Orangeburg, N. Y., was recently elected president of that company. Mr. Robertson has been with the Fibre Conduit Company for a number of years.

▶ OVINGTON E. WELLER, chairman of the Maryland Public Service Commission, and ABEL WOLMAN, engineer and chairman of the Maryland State Planning Commission, have been appointed delegates to represent Maryland at the Third World Power Conference to be held in Washington in September. They were appointed by Gov. Harry W. Nice.

▶ F. J. STOUFFER, formerly assistant to the purchasing agent of the Penn Central Light & Power Company, Altoona, Pa., has been promoted to the position of purchasing agent to succeed the late George T. Nophsker. A graduate of Gettysburg College, Mr. Stouffer has been affiliated with the purchasing department of Penn Central Light & Power for the past ten years.

▶ BREWSTER S. BEACH, for the past six years advertising manager and director of publicity of Carrier Corporation, air-conditioning manufacturer, Newark, N. J., has resigned to enter into business as publicity and sales promotion counsel, with offices in New York. Mr. Beach was formerly assistant advertising manager of the American Radiator Company, account executive of the H. K. McCann Company and co-director of the General Electric news bureau, Schenectady. His newspaper training was received on the New York *Sun*, where he was successively reporter, dramatic editor and assistant night city editor.

SIMPLE PRACTICAL DESIGN

FINEST RAW MATERIALS

CAREFUL WORKMANSHIP

HIGH EFFICIENCY

GOOD REGULATION

RUGGED CONSTRUCTION

COORDINATED PROTECTED BUSHINGS

SOLDERLESS CONNECTORS FOR ALL EXTERNAL CONNECTIONS

AMPLE CLEARANCES

HIGH IMPULSE STRENGTH OF WINDING

L-M DISTRIBUTION TRANSFORMERS

Ask your L-M Salesman to show you the cut-away Transformer

—WRITE FOR CATALOG T-2

LM

LINE MATERIAL CO.

SOUTH MILWAUKEE, WISCONSIN, U. S. A.

Electrical World Photo

Dr. William D. Coolidge (right), director of General Electric's research laboratory, studies the problem presented by President Swope's tie, at the recent M.I.T. banquet

▶ ROBERT K. JEFFRIES, for the past six years Southern district manager of the Alabama Power Company, with offices in Montgomery, Ala., has resigned to become general manager of the Montgomery City Lines, Inc., recently inaugurated bus service. B. B. Marsh, superintendent of the Southern division, has been appointed to succeed Mr. Jeffries.

▶ FRANK A. COFFIN, sales manager Milwaukee Electric Railway & Light Company, has been elected president of the Wisconsin Utilities Association, succeeding G. V. Rork, Northern States Power Company. Bruno Rahn, vice-president and general manager of the Milwaukee Gas Light Company, was named vice-president, and C. E. Kohlhepp, Wisconsin Public Service Corporation, Milwaukee, treasurer.

▶ F. A. GABY, formerly assistant to the president, Canadian Pacific Railway Company, Montreal, has become executive vice-president and director of the British American Oil Company. Mr. Gaby was chief engineer of the Hydro-Electric Power Commission of Ontario from 1912 until he joined the Canadian Pacific Railway in 1934. Mr. Gaby has been active in the American Institute of Electrical Engineers, having served on the committee on power transmission and distribution and on the Edison Medal committee.

▶ MAJOR JAMES M. BOYLE of the Rural Electrification Administration's staff, has been loaned to the Public Service Commission of Pennsylvania, where he will serve as a special assistant to the chairman to advise on inventory and appraisal matters. Major Boyle was for many years a member of the staff of Sanderson & Porter. After service in the Army he became vice-president of the Fred T. Ley Company in New York. For four years he was vice-president of the Underpining & Foundation Company of New York. For five years he was engaged in consulting practice with Boyle, Coleman & Travis, with headquarters in New York. Two years ago he joined the staff of R.E.A. as a special assistant to the administrator. During four months of this time he served as general manager of the Electric Home and Farm Authority.

▶ LEE W. EIGHMY, JR., has recently entered the sales department of the Kerite Insulated Wire & Cable Company, Inc., New York. A graduate of the Sheffield Scientific School at Yale, Mr. Eighmy was formerly connected with the sales department of the American Forge Company at Chicago, Ill., the Reading Iron Company, Philadelphia, Pa., and most recently has been assistant to the general superintendent of the Buffalo General Electric Company, Buffalo, N. Y. In his new connection with Kerite Insulated Wire Mr. Eighmy will devote his time to the sale of wire and cable to the electric light and power industry.

OBITUARY

▶ REID CARPENTER, retired attorney and one of the organizers of the Ohio Brass Company, died May 11. He was 83 years old.

▶ SIR PHILIP NASH, formerly chairman of the Metropolitan-Vickers Electrical Company, London, England, died May 1, from pneumonia, in his sixty-second year.

▶ THOMAS SPENCER, an early associate of Thomas A. Edison and George Westinghouse, died recently at his home in Indianapolis, in his eighty-first year. Early in life Mr. Spencer was made an assistant to Frank Sprague and was sent to various Edison plants as installation electrician. Subsequently he accompanied Westinghouse engineers to England, where he assisted in installing a plant in London. Mr. Spencer was a member of the Edison Pioneers and the American Institute of Electrical Engineers.

▶ JOHN L. PEGRAM, chief electrical inspector for the State of Washington, died recently in Olympia, as the result of a heart ailment. Mr. Pegram had been connected with the electrical industry for many years, operating at various times as wire man, electrical contractor, inspector and finally chief inspector.

▶ WILLIAM A. BOYLES, for the past 24 years purchasing agent of the Tennessee Electric Power Company, died April 19, after an illness of more than a year. He was 55 years old and one of the oldest employees in point of service with the power company, having been actively connected with the company and its predecessor companies for a period of 33 years.

▶ BURTON L. DELACK, general assistant to Vice-President W. R. Burrows of the General Electric Company and until two years ago manager of the company's Schenectady works, died May 7, following a stroke suffered at his office the previous afternoon. Mr. Delack went to the office of works manager just as the biggest boom in the history of the plant was approaching its climax. Pressing problems of production occupied his attention throughout 1928 and 1929, and in the latter year the Schenectady works saw its greatest volume of output. In 1934, because of impaired health following an operation, he asked to be relieved of the responsibilities of the position and was transferred to the staff of Mr. Burrows, vice-president in charge of manufacturing.

▶ EDWARD M. BENTLEY, retired attorney and a pioneer in the electric street car system in this country, died April 30 at his home in Lawrence, L. I., after a long illness. He was in his seventy-eighth year. Soon after his graduation from Yale University he became an assistant examiner of patents in the electrical division of the United States Post Office at Washington, D. C. In 1883 Mr. Bentley and Walter Knight, another assistant examiner, saw the possibilities of an electric street car system and the following year the Bentley-Knight Electric Railway Company was incorporated. The company was acquired in 1889 by the Thomson-Houston Electric Company, which was subsequently combined with the Edison Electric Company to form the General Electric Company. Mr. Bentley became the first head of the patent department of the General Electric Company, remaining with that organization until 1894. During the succeeding years he practiced law and was retained in many litigations as a patent expert.

WITH BRASS BUSHED HEMINGRAYS . . .

NO. 720
13,500-VOLT RATING

D-514
15,000-VOLT RATING

D-518
LEAD-BUSHED

– ratings up to 15,000 volts . . .

"LINE UP" with these Hemingray Advantages

1. Brass-bushed smooth threads for insulator pin.
2. Greater mechanical strength.
3. Sustained dielectric strength.
4. Unaffected by sudden temperature changes.
5. Withstand maximum insulator pin expansion.
6. Never age or deteriorate.
7. Controlled uniformity of product.
8. All surfaces impervious to moisture.
9. Tougher—withstand rough handling.
10. Clear and flawless for easy inspection.

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Why don't you use your indoor type Transformers on outside work?

INSTRUMENT
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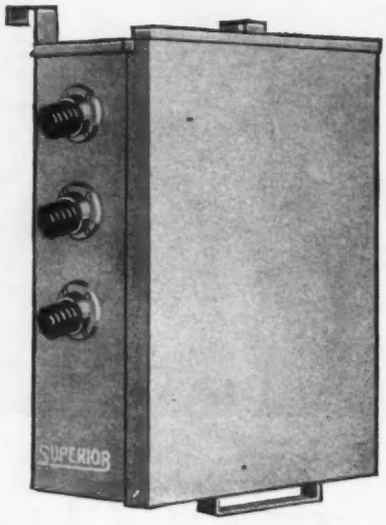
For Outdoor or Indoor Service

Type I-T instrument transformer enclosures provide a safe, rugged and economical housing for your transformers.



Bulletin 347 Lists standard sizes. Sure we'll mail it. Specials?—of course if you need 'em.

Superior Switchboard & Devices Co.
Canton, Ohio

*Been at it Since 1920

SUPERIOR
REG. U. S. PAT. OFF.

Lighting Problems Are World Wide

Electric lighting "represents the most nearly depression-proof part of the entire electric load." This sentence might have been written in the United States, but as a matter of fact it appears in a paper presented by Bruno Seeder before the German Illuminating Engineering Society last July, of which copies are now available in English.

A European survey shows that in several countries a seemingly high saturation of home lighting has been attained as is shown in columns A and B of the table. But in general the actual consumption per capita of energy for lighting is quite small. This appears in column C.

The annual consumption for rural homes is stated to lie between 60 and 120 kw.-hr., but in the towns it may be 50 to 100 per cent greater. It will be seen that this is much less than in the United States. In energy for street lighting Italy leads all other European countries with 6 kw.-hr. annually per capita, against 18 kw.-hr. in the U. S.

As in the United States, prospects for increased energy consumption are seen in "More Light Campaigns," rates favoring larger use, changing habits of the population in response to technical developments and improved economic conditions.

Home Electrification in Europe

Country	A	B	C
Austria	*55.9	62.7	....
Belgium	70.0	98.7	34.2
Bulgaria	....	....	5.0
Denmark	*70.5	100.0	41.2
Finland	*65.0	66.4	25.1
France	*93.6	97.6	39.4
Germany	*75.3	87.7	....
Great Britain	43.7	97.4	†70.9
Holland	74.7	96.3	65.4
Hungary	34.4	61.4	15.8
Italy	56.0	93.4	21.4
Norway	*68.0	69.0	....
Poland	....	....	4.5
Russia	....	....	9.8
Sweden	84.5	91.7	....
Switzerland	99.0	100.0	47.0

A—Per cent of homes connected to service.
B—Per cent of homes to which supply is available.
C—Annual lighting consumption, kw.-hr. per capita.
*Approximate. †Lighting and domestic consumption.

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Utility Workers Contribute to Relief Fund

Announcement was made last week by the United Campaign officials handling relief funds in Philadelphia that a gift of almost $12,000 had been received from employees of the Philadelphia Electric Company. Employees of the Philadelphia area of the utility company gave a total of $11,097 and employees of the main line division are credited with $430.

St. Louis Has a Plan That Builds More Load

Delegates to the Convention Will Have an Opportunity to Study an Unusual Experience in Market Development — Under Utility Leadership Dealers Are Now Selling in Co-ordinated Programs — What Has Been Done to Trade Relations and to the Load Curve

By EARL WHITEHORNE

JUST twenty-six years ago the power industry had its first vision of a great new market in the home. The National Electric Light Association was meeting that May in St. Louis, just as it is this month. Executives gathered to discuss operating, engineering, financial and political problems. A limted number of "new-business managers" were on hand, to attend four commercial sessions. But they were not supposed to make much noise.

George E. Hughes turned up, however, with a new electric cook stove—a kitchen range—and that caused a bit of a stir. It had been talked about and it sounded like a wild idea. But here it was. Everybody stopped and took a look at this ugly duckling. The sales managers doubted if they could sell them. The chief engineers shook their heads over this kind of load on the system. The general managers made mental note that it would need a low rate and upset the apple cart. The presidents hurried out to get ready for dinner.

Certainly there is justice and some drama in the fact that the power industry gathers again in St. Louis this year. For the electric range has become a most important builder of load, at this time when all executives are looking to increased domestic consumption as the only apparent answer to a pressing need. And they will see in St. Louis —if they take time to study it—the results of a remarkable experience in domestic load building.

If the meeting room doors were closed and the delegates locked out the time and cost of this convention could be well spent that way. For if the other power companies all took advantage of this opportunity to examine closely just how the Union Electric Light & Power Company has organized market development in this community, much good would come of it.

The simple slogan that has sold the idea that electricity is cheap

The Union company has performed no miracles. It has broken no records, in terms of average annual domestic consumption or appliance sales per consumer. But it has worked out a basis of trade co-ordination in load building and organized a moving program of creative selling by a united industry, that is accomplishing remarkable results and has some unique features.

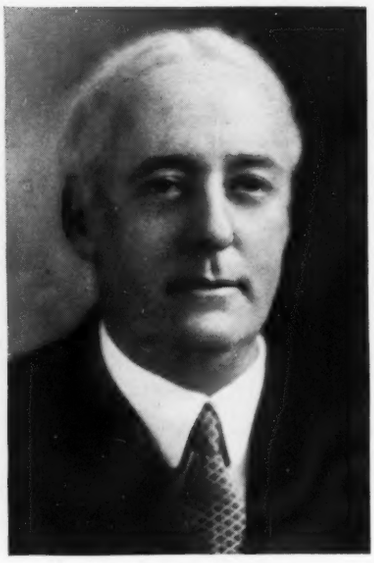
Other companies, of course, have also developed local industry co-operation effectively. The point is, however, that St. Louis has evolved a method and gained an experience of great value to other utility managements. And the convention of the Edison Electric Institute provides a convenient opportunity for them to take advantage of it.

It came about in an interesting way. The Union company had been selling appliances aggressively for years. Company officials had maintained the usual type of "cordial relations" with the contractor and dealers. They contributed to the local electrical "board of trade," attended industry meetings and so on. But in 1933 came the crest of the wave of opposition to utility merchandising. It culminated with the Kansas and Oklahoma laws. A bill was also presented in the Missouri Legislature. C. E. Michel, then sales manager, now vice-president, appeared against it and was surprised to find so many St. Louis retail merchants lined up against him. Some of them, whom he had thought were on the best of terms with the company, had contributed large sums to back the bill, one as much as $1,500.

The bill was defeated by a hard fight. Everybody expected it to come up again. So here was a situation. Michel and President Louis H. Egan decided that they had been overlooking something and determined to build up a closer friendship with the dealers.

Michel went to work and devoted a lot of time to talking with department store men, directors of local hardware, furniture and other retail associations, as well as electrical contractors and dealers. Their attitude about reflected the classic admonition, "Beware of the Greeks bearing gifts!" But by persistence and much talk, backed by Charlie Michel's frank and forceful personality, enough interest was drummed up to justify the calling of a dinner meeting of all the sellers of appliances.

Charles E. Michel
Vice-President



Louis H. Egan
President

The spectacular success of the St. Louis merchandising plan is due to Mr. Michel's vision in creative planning, his genius for harmonizing conflicting interests, his unflagging enthusiasm and his tireless energy. But Mr. Egan's faith in the underlying principles behind the program and his courage in supporting it have been no less vital.

To this gathering Michel outlined the basis of the plan he had in mind. In a word, he proposed that the mechanism of the local Refrigeration Bureau, which had been very successful, be expanded to assist in the promotion and merchandising of all electrical appliances. The company would continue merchandising, but would broaden its promotional activities to provide assistance to the other dealers. Michel wanted to function as one among the dealers and speak their language and know their problems. He also wanted to be in a position to pioneer new ideas and support appliances that any time were being neglected by the other dealers for any reason.

The plan was launched. Since then it has been building up experience in both the organizing and operation of market development on a community-wide scale. It has evolved a mechanism for uniting the utility, the retail dealers and the wholesalers and manufacturers in concerted promotion and sales that has materially improved competitive conditions in the trade and the service which the public is enjoying.

The inauguration of this program was considerably stimulated by a sweeping rate reduction, which was announced in November, 1933. This cut the cost of electricity to the people of St. Louis by $1,300,000. It was given extensive publicity and made the theme around which the value and economy of electric service in the home was demonstrated. It was not an essential part of the movement. The plan could have been developed without it. But it gave a strong boost to the program.

Panoramic view of a co-operative range display on the Union Electric sales floor. Here each

Step by step, here is the way the job has been done:

1. *Planning the Program* — The first move was the selection of a nationally known advertising agency, with which the Union company crystallized its plan into a sales campaign. The *Electric News*, an established local bulletin of information, was made the medium for tying everybody together, in all nearly a thousand names, and keeping them in touch with developments, opportunities and features of the moving program.

2. *Selling the Idea* — It took a series of meetings to talk the idea through and find everybody's part in it. First, the manufacturers and wholesalers were brought together and the vital necessity of this co-operation was established. Next, the larger dealers met and took their position. Then a meeting of the jobbers' salesmen enlisted their aid to make contacts with the small dealers and expound the benefits to them. Then followed the full meeting of the entire appliance industry—more than 700 were present as guests of the Union company—and the opening campaign was presented in dramatic form.

3. *Industry Organization* — Bureaus were formed within the St. Louis Electrical Board of Trade to take over the co-ordination of the many objectives of the program. The existing Electric Refrigeration Bureau, Air Conditioning Bureau and Electric Cookery Council were tied in. A Better Light—Better Sight Committee, a Wiring Contractors Section and a Rural Electrification Committee were added. An Appliance Sales Promotion Committee was set up embracing an Appliance Retailers Advisory Council, and under that a Sales Promotion Committee and a Trade Relations Committee, under which were sections on radio, refrigerators, washers and ironers, ranges and air conditioning. A duplicating set of committees was provided for the wholesalers, with the necessary staff.

4. *A Sales Manager* — The next move was the employment of a sales promotion manager with broad advertising and promotion experience. His job was to conceive, organize and operate the program to create demand, bring customers into the dealers' stores and uncover prospects, working in co-operation with distributors and retailers.

5. *A Merchandising Counsellor*—Then followed the hiring of a merchandising counsellor, a man with years of experience in dealer contact work in the St. Louis area. He knew the personalities and the local problems. His responsibility was to help the small dealers to change over from passive to aggressive selling.

6. *The First Campaign*—The opening sales campaign was built around newspaper advertising, radio broadcasts and billboards. This was supported by dealer-help material to tie in the retailers' stores. The whole campaign was put into the hands of every dealer, wholesaler and manufacturer in a large impressive portfolio—that gave him a dramatic picture—rates, newspaper ads, tags to attach to appliances, the radio schedules, billboard posters, counter displays, folders, and what to do—on the 1-2-3-4 basis.

7. *Supporting Contact*—The merchandising counsellor is primarily a customer-contact man. But the company's staff of salesmen are at his disposal, as necessary, to give aid and guidance to the dealers individually. Supporting this are frequent meetings of dealers in small groups, supplemented from time to time by larger general meetings. Contacts with the larger dealers are normally made by Mr. Michel himself, many others by the company sales manager and the merchandising manager.

8. *Special Company Service*—All divisions of the Union company's sales department give assistance. Installment collections on dealers' sales are made on the Union company's monthly bills. Demonstrations are made for dealers' salesmen in the company's kitchen. Co-operative displays on the company's main sales floors are developed by the company's display department. Co-operative dealer advertising and promotion are handled by a special section in the company's advertising department.

9. *Continuing Campaigns* — Succeeding campaigns have been conducted, with the same build-up each time—meetings with manufacturers, wholesalers, large dealers, jobber's salesmen and then the mass meeting of the entire local industry—then advertising—publicity—promotion to whip up campaign enthusiasm. In the spring of 1934 a drive on domestic, commercial and industrial lighting, then another appliance campaign, with balanced emphasis on all important appliances. Then in October a renewal of the pressure playing up seasonal appeals.

In the spring of 1935 came a new bombardment, and again in the fall, with particular pressure on ranges, refrigerators and air conditioning. Again this spring a drive was made on the kitchen, with the emphasis on cooking and the care of food.

Charlie Michel has followed a definite psychology of approach in presenting these recurring campaigns to the dealers of St. Louis. Elaborate announcements burst upon them, overpowering in size and color. The large dealers, the department store executive type, require this heavy artillery to beat down resistance and capture attention. It is, of course, even more effective with the smaller dealers. It works. And the announcements carry samples of ads, full size, and hand the dealer ready-made advertising pieces for distribution to his customers and material for the use of his salesmen.

In a word, the Union company has scaled up its advertising and selling so that it brings the dealers right into an industry sales organization. They

make of range is shown, distributors and retailers are listed and prices are marked plainly

What St. Louis dealers think of electric ranges. Such pressure of promotion has been put behind this "pioneer" appliance that it is now featured in most dealers' stores and the merchandise moves at a profit.

One of the mass meetings that precede each campaign to dramatize the opportunity and kindle competitive zeal

are all working under an industry plan and the united power of it makes more sales for everybody—and everybody is thereby building that much more load for the utility. It is a perfectly frank and practical co-operation for material benefit.

Meanwhile the Union company has never reduced its own merchandising operations. But as dealer volume has grown, its proportion of the local business has declined. For there are now some 1,100 dealers taking part in these intensive selling operations. Much of the results of the company's sales efforts now appear as dealer sales.

The company holds strictly to list prices and does not indulge in any special deal or promise or other sales stimulus which would give it an advantage. Dealers are encouraged to check up on company salesmen and "shop" the company stores in order to assure themselves that this competition is fair and to uncover and report any unfair methods that might crop up. It is a high testimonial to the extent to which Michel has inspired his own organization with the broad purpose of the program that only two complaints of this kind have been reported in the past year.

There are some dealers, of course, who still think that the company should withdraw entirely from merchandising, but most of them recognize the value to them of having this strong leader in the field. They have seen the benefit of having the sales manager of the utility able to measure customer demand and promptly recognize the need for change in policy when it develops. Michel is convinced, by the last two years' experience, that it is vital for the utility to be in a position to set an example in wideawake aggressive merchandising and in fair dealing.

Evidence of benefit

And now what has come of all this?

This pertinent question can be answered in two ways: First, the immediate objective in organizing this co-operative program was to improve trade relations in the electrical industry in St. Louis. It was not long before there were results. In 1934 another attempt was made to push an anti-merchandising bill through the Missouri Legislature. But a carload of St. Louis dealers went down to Jefferson City and declared their conversion and killed the bill.

The other test comes in the quantity of electrical merchandise sold onto the lines of the Union company from all outlets. Here the answer is disappointingly incomplete, but none the less convincing. Charlie Michel has refused to compile figures on the total sales of the industry. He insists on free and open competition. He has made no effort to compile mass statistics—except on ranges and refrigerators—but wholesalers and dealers have both reported percentage increases in their volume which are illuminating.

As to range sales, here are the figures:

	Company Sales	Dealer Sales	Total
Year 1934	280	320	600
Year 1935	943	1378	2321
First 4 mos. 1935	159	173	332
First 4 mos. 1936	383	675	1058

In 1934 sales by dealers accounted for about 50 per cent of the total number of ranges sold, more than during the preceding twenty years. In 1935 dealers sold over four times as many ranges as in 1934.

As to refrigerators, the totals were:

	Company Sales	Dealer Sales	Total
Year 1932	819	15,727	16,546
Year 1933	1335	20,512	21,847
Year 1934	1518	31,281	32,799
Year 1935	1018	38,987	40,005

There are many letters from wholesalers and dealers telling how much their appliance business had grown in 1934 over 1933. In the wholesalers' letters we find percentages of 50, 100, 150, 250, 300. Retailers also claim gains of 50, 150, 200, 250 per cent, and there are plenty of these letters, an impressive display of testimonials to the improved competitive conditions and the swelling volume. And the same thing happened over again in the year 1935.

From the standpoint of the power

company, of course, the ultimate objective, growth of load. Well, in 1934 domestic appliances sold by the company added 21,051 kw. and in 1935 a further 23,266 kw., while for the first quarter of 1936 the total is 4,137 kw. The figures on increase in average annual domestic consumption are also interesting. On December 31, 1933, they stood at 754 and a year later had risen to 824, and at the end of 1935 they registered 870 kw.-hr. Here was a growth of 116 kw.-hr. consumption per residence customer in two years, built up principally out of ranges, refrigerators, air conditioning and lighting sales. It has lifted the summer valley on the load curve into a peak, in just two years. There are 250,000 domestic consumers on the system.

Meanwhile, of course, work had not stopped in the building of industrial and commercial load, but this presented an altogether different problem. A continuous pressure was maintained on plant modernization, involving customer surveys, pending a resumption of business that would justify a plant expansion. The results of this work are now showing as general business picks up. Both residential and commercial lighting was promoted by a staff of advisers, who made more than 4,500 calls during 1935. The following gains were recorded:

	Year 1934	Year 1935	3 Mo. 1936
Industrial heating	1,428	2,993	1,184
Commercial cooking	333	706	430
Lighting	1,455	1,307	366
Isolated plant replacement	3,574	2,086	998

St. Louis has been a pioneer in air conditioning and the story of Mr. Michel's activity in that field, where he has headed the E.E.I. committee work, needs no telling here. Air-conditioning load put on the lines up to December 31,1933, totaled 5,520 kw. To this 1,091 kw. was added in 1934 and 4,211 in 1935. And in the first three months of 1936 1,538 kw. more was put on the lines.

The Union company's over-all kilowatt-hour output has now begun to exceed previous peak years. The effect on the load curve is both interesting and conclusive. The summer valley has been filled up with cooking, refrigeration and air conditioning, until it is beginning to call for special attention to some seasonal load for March, April, May and June.

The final question is cost. And here there is no precise yardstick to measure by, because we must compare promotion for company sales with promotion for industry sales, that looks for its return from load added by dealers. Naturally, it costs more to promote business for several hundred retail outlets than through one utility merchandising department. But it is building more load, where it is needed. The pre-depression rate of growth began to slow off in 1933, but resumed its upward curve when the new program was adopted.

The Union company has continued its usual percentage of advertising expenditure to support its own merchandising department. The cost of co-operative advertising and demonstrations and service for dealers has been added. New-business advertising expenses over the three years 1931 to 1933 averaged $111,573 per year. During 1934 this average was increased by $49,251 and in 1935 by $62,522. Total new-business expense was increased 40 per cent in 1934 and 65 per cent in 1935, again over the average of 1931 to 1933. But this must all be measured against the community accomplishment that is building up a load-creating force of steadily increasing strength.

Of all this, Charlie Michel says:

"While our own merchandising department is functioning as vigorously as possible under this severe handicap of building up our competitors, it can hardly be expected that our own sales will show the true accomplishment. There would be absolutely no difficulty in increasing our own merchandising sales many, many-fold if that were our objective, but we do not want to disturb the market by resorting to the well-known forcing methods in order to attract the business to our floor.

"We are absolutely convinced that the maximum can be accomplished by keeping the utility as an active and aggressive competitor on the plane I have spoken of and, at the same time, building the number and the volume of the retail outlets, including department stores, furniture stores, hardware stores and electrical dealers. That our plan is working out is very clearly demonstrated by, first, the radical improvement in the twelve months characteristics of our residential load, as well as its volume, and, second, the appreciable movement of customers from low-bracket consumption to the higher brackets."

And there is the story. The record, the exhibits, the witnesses and the details of method, policy, organization and administration will be available in St. Louis during the convention. It will offer to the visiting executives from other cities the results of an experience which they should all at least understand. For it is rooted in some principles which are of basic importance in every community.

Lots of other utilities also believe in co-operation and are practicing it. It may be thought by some that this adventure in St. Louis holds nothing new for them. But Michel, backed by Egan and Frank J. Boehm, the executive vice-president, has built up a unity of action and a pressure for sales that stands unique in many aspects.

Home of Mrs. J. M. Fuller
West Side Geyer Road, ½ Mile North Manchester

Number of Rooms 8
Number in Family 6
Number of Electric Appliances 11
PLUS AN ELECTRIC RANGE
AVERAGE MONTHLY BILL $6.90

ELECTRIC APPLIANCES IN USE: REFRIGERATOR, RADIO, WASHER, IRON, MIXER, TOASTER, PERCOLATOR, COOKER, CLOCK, WAFFLE IRON, CLEANER

"We are more than pleased with our electric range. It cooks food so much better and needs no watching. We do a great deal of cooking and find it inexpensive," says Mrs. Fuller.

1934-35 Electric Bills including Electric Range

June 1934	$6.13
July	7.24
August	5.93
September	6.13
October	5.98
November	6.81
December	7.01
January 1935	7.55
February	6.95
March	7.52
April	8.09
May	7.50

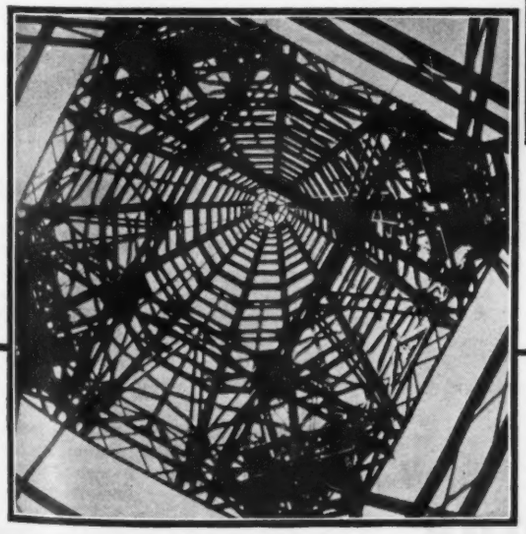
This page, from a St. Louis booklet, pictures houses, quotes monthly bills, lists equipment, describes the household, and gives a testimonial

A MILEPOST OF STEEL

on the Sands of Time

THE hundredth anniversary of the birth of General Justo Rufino Barrios, famous Guatemalan patriot, is signalized by this beacon and bell memorial tower over the intersection of the Boulevard 15 de Septiembre and the Calle Miguel de Granados, Guatemala City, Central America.

It may be unusual but quite fitting for a modern land to erect memorials of steel, a newer material of known strength and long life, adaptable to any construction purpose or esthetic treatment. The entire job of design, fabrication and erection was given to American Bridge Company because of the wide experience of their engineers in all kinds of structural steel-work. Plain material was rolled by the Carnegie-Illinois Steel Corporation.



(*Above*)—Visible at night throughout Guatemala City, this floodlighted 246′ galvanized tower stands on four legs centered 104′ apart, leaving an arched roadway 82′ wide and 39′4″ high for the passage of vehicles in four directions. The base structure rises 64′6″, the lower ends of the legs being supported and protected by four corner pylons 31′ high.

(*At left*)—Looking up into the twelve-sided shaft towards the bell, observation walk, and 3,000,000 candlepower revolving beacon light.

AMERICAN BRIDGE COMPANY, Pittsburgh, Pa., CARNEGIE-ILLINOIS STEEL CORPORATION, Pittsburgh, Pa., Chicago, Ill., TENNESSEE COAL, IRON & RAILROAD COMPANY, Birmingham, Ala.

Pacific Coast Distributors: Columbia Steel Co., San Francisco
Export Distributors: United States Steel Products Company, New York

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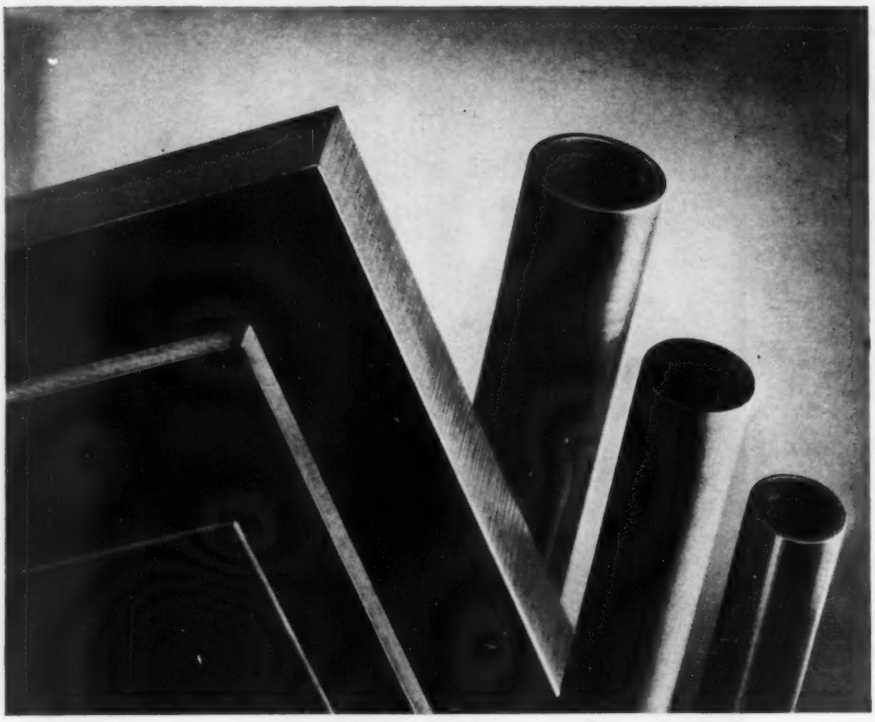

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Available in both paper and fabric bases . . . in practically any lengths and thicknesses. Easily cut, machined and threaded. Can be furnished flexible, for cold or hot punching. Other properties can include high dielectric and mechanical strength, low moisture absorption, or resistance to chemicals and alkalies.

The new Price List #101 describes the complete line of Laminated Bakelite as well as Micanite, Varnished Cambric and other insulating materials. Write for a copy.

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200 Varick Street, New York; 542 So. Dearborn St., Chicago; 1276 W. 3rd St., Cleveland. *Branches at* Birmingham, Boston, Cincinnati, Los Angeles, San Francisco, Seattle. *Canada*: Montreal, Toronto.

Municipal Plants

PIGGOTT, ARK.—City Council has passed a resolution urging the Arkansas-Missouri Power Company to remove its poles and lines from the city, contending that the municipal power plant is capable of furnishing all the power needed. The utility company's franchise expired March 31 and City Council refused to renew it.

NAPA, CALIF.—Voters on the lines of the Pacific Gas & Electric Company decisively vetoed a proposal that the city embark upon a municipal ownership program in a recent election. By a vote of 1,538 to 704 they opposed a test question, "Do you favor municipal ownership of electric light and power for Napa?" The measure was placed on the ballot to test popular sentiment before committing the city to expenditures for an evaluation of the existing privately owned system.

MANCHESTER, IOWA—Iowa Electric Company won a twenty-year franchise by a majority of 57 votes in a city election held recently. One thousand votes were cast. The old franchise expired last winter. The utility plans the construction of a division office and has also offered lower rates and an improved street lighting system.

MILFORD, IOWA—City's ouster suit against the Northwestern Light & Power Company has been moved from Dickinson County district court to the federal courts upon an order by Judge George A. Heald. Patrons are still being served by the Northwestern Light & Power and the street lights are still in operation under contract made several years ago. The municipal power plant has been in operation since April, 1935.

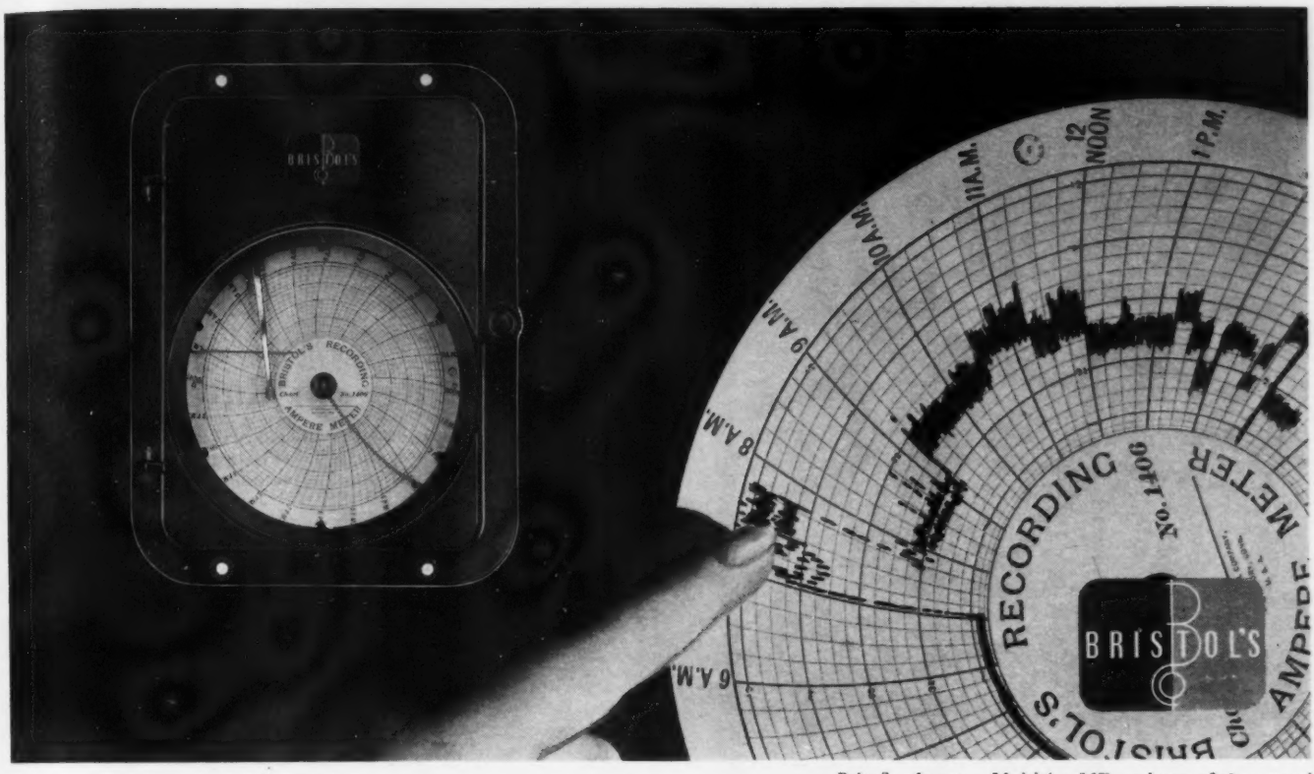
SENECA, KAN.—Plans for the construction of a municipal light and power plant for which the P.W.A. had allotted an $85,000 grant and loan have been abandoned. City officials decided to accept the terms offered by the United Power & Light Company of Abilene, which for some years has been selling energy to the municipal distribution system.

CAMPBELL, MO.—Arkansas-Missouri Power Company has been ordered by the state Supreme Court to remove its electric light plant and distribution system and cease competition with the municipal plant now in operation. In its opinion the court pointed out that the city had established a municipal light and power system capable of adequately serving all of its inhabitants and now is serving most of the available customers. "Without the consent of the municipality, no right exists to operate an electric plant therein," Judge Ernest M. Tipton held. The franchise of the utility expired in January, 1935, and a contract to furnish street lights ended in May, 1935. At the expiration of the franchise the city refused to renew it.

LINCOLN, NEB.—Gov. Roy L. Cochran has signed a bill to permit cities and villages to acquire or construct light or power plants and transmission lines by pledging earnings. This bill corrects defects in an existing law which the Supreme Court had voided in part.

GRAND FORKS, N. D.—Voters have turned down a proposal to construct a municipal electric plant. In a referendum election on ordinances awarding the contract to the Donovan Construction Company of St. Paul for $650,000 and selling $700,000 worth of 5 per cent revenue bonds, the electorate turned thumbs down. The issue of the campaign was the awarding of both contracts without competitive bids. The vote on the contract ordinance was 3,077 against and 1,913 for, while the bond issue was defeated 3,089 to 1,893 in the unofficial tabulation.

HETTINGER, N. D.—Voters have rejected a



Bristol's Ammeter, Model 640MF, and part of chart record

A peek at the peak *led to lowered demand rate*

BECAUSE THE bills for the power it was purchasing on a maximum demand rate seemed exorbitant, a certain industrial plant didn't feel it was getting all it paid for. An unpleasant situation arose. Something had to be done.

A Bristol's Recording Ammeter was called into service. The current consumption throughout the day was charted. Every fluctuation, every change in load and the time such change took place, was recorded. As a result, it was found that a high peak occurred between 7 and 8 a. m.

The remedy was simple. A minor change was made in plant routine, the peak was eliminated without curtailing plant capacity, and power charges were amicably and satisfactorily adjusted.

This instance is typical. For a complete, convincing story of power consumption that is not open to argument, there is nothing like a chart record made by a Bristol's Ammeter. It discloses the initial inrush as well as the operating current under variable loads. It also furnishes valuable information in such applications as controlling motor-driven mixers and wire-drawing equipment.

Furnished in flush panel, wall or switchboard, and portable models. Write for Bulletin No. 436W.

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PIONEERS IN PROCESS CONTROL SINCE 1889

BACKED by an organization that has maintained its position of leadership in the wood preserving industry for more than 30 years, AmCreCo poles offer economies in line construction that spread the initial cost over many years. Strength, dependability and resistance to decay throughout their serviceable life give assurance of low annual cost that represents a saving every year.
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INCORPORATED
AMCRECO
LOWRY PROCESS
GEORGIA CREOSOTING COMPANY
INCORPORATED
LOUISVILLE — KENTUCKY

plan to erect a municipal light and power plant, following the defeat of candidates favoring a bond referendum.

YORKTOWN, TEX.—Validity of the recent municipal election at which $65,000 of bonds for the construction of a municipal electric light and power plant was voted is contested in a suit filed in the district court by the Central Power & Light Company. The petition alleges that there were irregularities in holding the election and that many conscientious voters were prevented from participating in the election by the enforcement of an erroneous rule that only those who had paid their poll tax and rendered property for taxation during the year could legally vote.

•

Recent Rate Changes

VIRGINIA PUBLIC SERVICE COMPANY has put into effect power rate reductions, ordered by the state Corporation Commission, amounting to $300,000 annually. The new rates will apply to the majority of both the residential and commercial customers in a half dozen Virginia cities and numerous towns served by the company. The reductions apply to all classes of the company's consumers except those in the "minimum use" group.

MOUNTAIN STATES POWER COMPANY recently has won a Supreme Court injunction against lower electric rates ordered by the Montana Public Service Commission for districts at Baker and Forsyth. The Supreme Court granted the injunction pending outcome of an appeal from the commission's ruling, a case which cannot be heard until next fall. The injunction was made conditional, however, upon the company's following an order of a three-judge federal court in Montana impounding the difference between the old and new rates and requiring the company to furnish bond.

KANSAS CITY POWER & LIGHT COMPANY'S rates were termed excessive in a complaint recently filed with the Missouri State Public Service Commission by the Consumers Protective Association of Kansas City. The additional charge was made that the company's service rules and regulations are unreasonable and inimical to the consumers of electric energy for commercial purposes.

DALLAS POWER & LIGHT COMPANY officials are negotiating with Utilities Supervisor Joseph Leopold for a schedule of lower domestic rates that will save householders approximately $500,000 annually. The reduction will range from 6 to 10 per cent. Present rates are on a sliding scale of 5½ cents, 4 cents and 2 cents, depending on the amount of energy used.

MISSOURI STATE PUBLIC SERVICE COMMISSION on June 15 will conduct a hearing to determine the present rate base valuation of the Union Electric Light & Power Company of St. Louis so that it can decide what rates should be charged. In a recent stipulation filed with the commission the city of St. Louis and the company agreed as to the value of the land and assessments for the company's hydro-electric plant on the Lake of the Ozarks at Bagnell, Mo.

CONOWINGO POWER COMPANY has filed revised schedules with the Maryland Public Service Commission which will bring about a reduction in rates of approximately $14,000 a year. The new rates become effective on June 1. Last October, following a public hearing, the commission handed down an order directing the company to reduce its rates by about $45,000 a year. The company obtained a court injunction. In a statement issued by Frank Harper, executive secretary of the commission, he said that after the court decision the commission entered into negotiations with the company in

electro-annealed malleable iron cap.

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rugged one piece porcelain.

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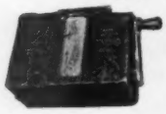

Inquiries for particulars and prices regarding instruments here illustrated are cordially invited. Descriptive literature will be forwarded upon request.

Midget "Megger" Insulation Tester
50 megohms, 500 volts

JAMES G. BIDDLE CO.

ELECTRICAL INSTRUMENTS

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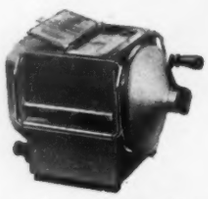
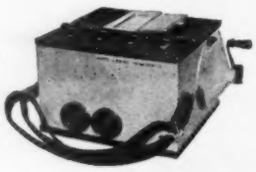
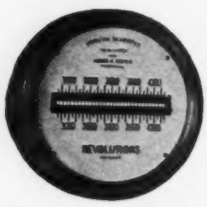


"Meg" Insulation Tester
Ranges up to 2000 megohms

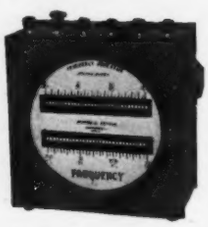
Jagabi Rheostat
4 sizes, 76 different ratings.



"Bridge-Meg" Resistance Tester
Ranges from .01 ohm up to 200 megohms



Frahm Vibrating-Reed Tachometer

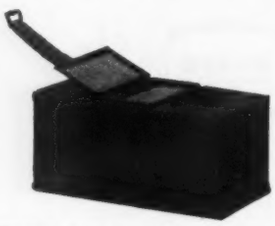


Frahm Vibrating-Reed Frequency Meter

Standard High-Range "Megger" Testing Set
Ranges up to 10,000 megohms. Hand generators rated up to 2500 volts

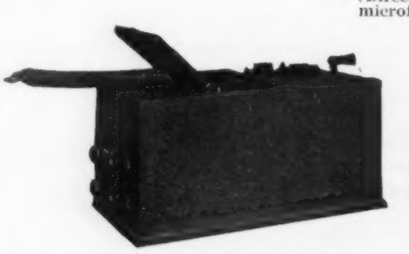
Midget "Megger" Circuit Testing Ohmmeter

Jagabi Speed Indicator

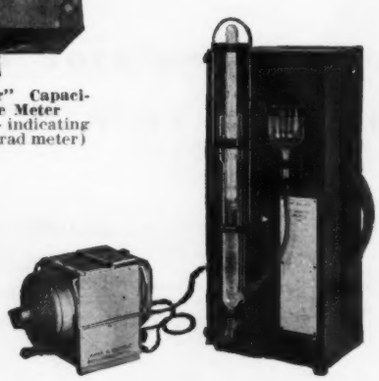


Ducter Low Resistance Testing Set

"Megger" Capacitance Meter
(Direct-indicating microfarad meter)



"Megger" Ground Tester
For measuring resistance to earth of ground connections.



Dionic Water Tester
For measuring conductivity of weak aqueous solutions

the hope that some satisfactory settlement might be effected. "While these efforts have not been successful, and it has not been possible to get the company to agree to a reduction sufficient in amount to justify the commission dropping the matter," Mr. Harper said, "the company has, however, recently filed with the commission revised schedules of rates which bring about a reduction in the company's charges of approximately $14,000 per annum. . . ."

IOWA-NEBRASKA LIGHT & POWER COMPANY is making a rate reduction beginning June 1 that will cost the company about $200,000 annually. The reduction is a direct result of a plant put in operation last year, known as the additional use rate, which increased consumption sufficiently to allow for the reduction. Under the new program the first two blocks remain at the same rate, but the customer who uses more than 40 kw.-hr. per month pays only 3 cents per kilowatt-hour as compared with the old rate of 3½ cents. Under the new plan the consumer is entitled to a rate of 2½ cents for each unit over 200, whereas under the old rate the customer had to use 500 kw.-hr. before he was entitled to a rate of 3 cents. This program applies to Lincoln, where the residential and commercial rates are the same. There is a slight variance from this plan over the company's territory depending upon the size of the town.

ELMIRA LIGHT, HEAT & POWER CORPORATION has filed revision of electric rates with the New York Public Service Commission which is estimated to save customers $62,450 annually in the territory of the company, which includes Elmira, Elmira Heights, Horseheads, Millport, Wellsburg, Burdette, Montour Falls, Odessa, Lodi and surrounding towns in Chemung, Schuyler and Seneca counties.

COLUMBUS, DELAWARE & MARION ELECTRIC COMPANY has made voluntary power reductions up to 14 per cent in Marion. The reduction, divided into two parts, will become effective July 1 and January 1.

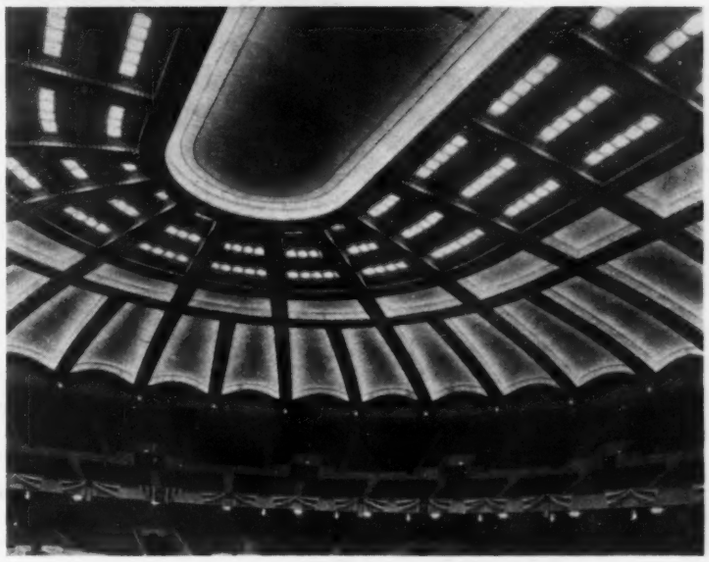
UNION PUBLIC SERVICE COMPANY at Canby, Minn., has announced a reduction in commercial lighting rates to apply to all of the 54 towns served by the company. The reduction will average approximately 10 per cent for the entire system.

NEW YORK CENTRAL ELECTRIC CORPORATION has announced rate reductions at Hornell and Dansville totaling $48,000 annually.

CONSOLIDATED GAS, ELECTRIC LIGHT & POWER COMPANY of Baltimore has announced a reduction in electric rates in Baltimore and vicinity amounting to approximately $813,000 a year. The new rates will apply to all consumption after the June meter readings. Although the reductions will apply principally to domestic consumers, adjustments in rates to small commercial, institutional and other customers are made. The primary rate in the Baltimore City rate district, under the new schedule, will be 4½ cents net per kilowatt-hour instead of the present 5 cents. The rate in the suburban rate district, will be reduced from 5½ to 5 cents net. In the outside rate district, which comprises all territory beyond the suburban rate district, the rate will be cut from 6.7 cents to 6 cents net. Reductions also will be made in the secondary and tertiary rates. In commenting on the cut Herbert A. Wagner, president, said: "The growth and development of the company's business resulting from the gradual return of more normal business conditions generally have made possible this latest rate reduction." The rate cut was the result of lengthy negotiations between the members of the Maryland Public Service Commission and Consolidated officials.

WELCOME E. E. I.

IN the very auditorium where the Edison Electric Institute holds its annual Convention is a striking example of the high levels of glareless comfortable conditions achieved by **BUILT-IN LIGHTING**



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DAY-BRITE REFLECTOR CO.

ST. LOUIS, MO

USING CONTROLENS BY

The HOLOPHANE COMPANY, Inc.

NEW YORK, N. Y.

Reliable

STRAIGHT LINE SPLICE . . .

"WE PUT TEETH IN IT"

- Holds wires under tension.
- Holds wires on light twisting pulls

- Holds used under-sized wires.
- Holds to approximate breaking strength on first used and repeated reuse.
- Improperly prepared wires won't enter.
- Made entirely of non-corrosive parts.
- Is easily reclaimed.

ORDER SAMPLES AND GET PRICES TODAY

Reliable ELECTRIC COMPANY

3145 CARROLL AVENUE • • • • • • • • • CHICAGO, ILLINOIS

26 YEARS SERVICE TO THE UTILITIES

British Extending Grid Stations

With the approval of the Electricity Commissioners, the British Central Electricity Board has completed arrangements for further extensions of the selected stations which feed the national Grid in order to meet the increase in the demand for electricity which is expected by the autumn of 1938. Since the beginning of 1936 the board has issued directions to the owners of selected stations for the installation of additional generating sets and boilers, which will increase the capacity of those stations by nearly 500,000 kw., representing orders of an estimated value of more than £5,000,000 ($25,000,00).

During 1934 and 1935 sanction was given for the installation at selected stations of more than 1,200,000 kw. of new plant, the estimated cost being nearly $75,000,000. Installations ordered for this year will thus bring the value of extensions initiated within the past three years to £20,000,000 ($100,000,000).

"General trading operations" resulted in a "credit balance" of about $5,100,000 (at present exchange rates) for the British Central Electricity Board in 1935, compared with a balance of about $430,000 in 1934 and barely $20,000 in 1933, according to the latest annual report.

•

Electrical Data in Land of Nile

Data on the power supply in various cities in Egypt, including capacity of generators, service voltage and frequency, on market possibilities and on electrical imports are given in a recent publication by the Electric Equipment Division of the Bureau of Foreign and Domestic Commerce, Department of Commerce. It appears as No. 16 of the series entitled "World Power Manual and Electrical Exporters' Handbook."

In general, European practice prevails as to frequency, 50 cycles being dominant with but few exceptions, usually at 200 volts, but ranging from 100 volts to 220 volts. The market for appliances is limited and, such as it is, is largely served from European sources.

There are only two large power plants, each of about 23,000 kw., which serve Cairo and Alexandria, in addition to a railway plant of 27,600 kw. The output of utilities is used chiefly for house and street lighting. A limited amount is utilized for industrial power and for pumping water for irrigation. Total output of utilities in 1934 was around 130,000,000 kw.-hr. Diesel power predominates, except in the largest plants.

As New Jersey goes forward Public Service *keeps pace*

NEW JERSEY is marching onward! The 1935 report of the Federal Census Bureau shows that the population of New Jersey increased 6.1 per cent in the period of 1930-1935 while that of its neighbors, Pennsylvania and New York, increased by 4.5 and 2.4 per cent respectively.

Public Service Electric and Gas Company supplies electric energy for about one-fifth of the state's area. In this one-fifth reside approximately 80 per cent of the 4,288,000 population and are located 90 per cent of the state's industrial plants.

As of December 31, 1935, there were 958,385 electric meters in use and 95 per cent of the industrial plants in the territory were obtaining central station power.

While New Jersey was showing the splendid increase in population, Public Service was showing an emphatic growth in the sales of electricity for use in the homes of the state. The average annual Kilowatt hour sales to the residence increased by about 25%. The first four months of this year show a 6.8 per cent gain over the corresponding period of last year.

Sales of appliances are showing a gratifying increase. For the first four months of this year 693 ironing machines were sold as against 371 for the like period last year; 8003 irons this year, 6684 last year; 3081 washing machines this year, 1847 last year; 1848 refrigerators this year, 871 last year, and corresponding increases in all departments of the appliance field.

Public Service, alert to its responsibility of serving adequately and efficiently the state's need for electric energy, keeps ahead of the demand as New Jersey goes forward.

Public Service Electric and Gas Company

OF
KNOWING HOW

SIGNAL CABLE
CONTROL CABLE
PARKWAY CABLE
MAGNET WIRE
RUBBER POWER CABLE
LEAD COVERED CABLE
VARNISHED CAMBRIC CABLE
WEATHERPROOF WIRE
ALL TYPES OF BUILDING WIRE

and all kinds of special cables to meet A.S.T.M., A.R.A., I.P.C.E.A., and all Railroad, Government, and Utility Companies' specifications.

CRESCENT
INSULATED WIRE & CABLE CO. INC.
TRENTON, NEW JERSEY

European Output Points to Recovery

Increasing energy consumption in Europe is shown by statistics published in "Electrical Foreign Trade Notes," but progress differs greatly in the several countries.

In Denmark consumption during the first nine months was 12 per cent greater in 1935 than in 1934. Less energy was generated, but more was imported and less exported. Figures in millions of kw.-hr. for plants generating about 96 per cent of the total output (1934 in parentheses) are: Generated 399.4 (420.1); imported 59.2 (19.5); exported 8.1 (38.2); consumed 450.5 (401.4).

In France the output during the first nine months was 1.8 per cent greater in 1935 than in 1934. Output in millions of kw.-hr. from thermal plants was 2,788.4, hydro 5,202.7, total 7,991.1 Corresponding figures for 1934 were: 3,058.9, 4,789.4, 7,848.3. Conditions seem to be improving, for in September the combined production was 893.9 against 848.3 a year ago, an increase of 5.4 per cent.

In Sweden production is now far ahead of that in 1929. There was only a small drop in 1931 and 1932. A sharp upward swing since 1932 indicates the marked improvement in the general economic situation.

Industrial plants are being mechanized, distribution networks extended, the use of electricity for power, lighting, cooking and other purposes is increasing. The growth is shown by the annual output, in millions of kw.-hr., as follows: 1929, 4,967; 1930, 5,212; 1931, 5,094; 1932, 4,903; 1933, 5,344; 1934, 6,000 (est.); 1935, 7,000 (est.).

•

Winnipeg Merger Completed

Announcement has been made by Edward Anderson, president of the Winnipeg Electric Company, that the general plan of consolidation and readjustment of the Winnipeg electric group of companies is now in force. Arrangements are being made to exchange securities as early as possible.

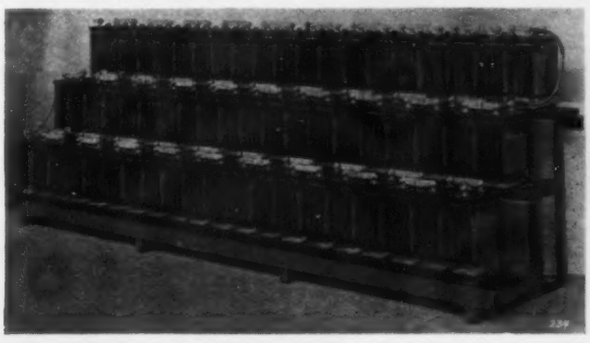
•

Five More Companies Adopt Reddy Kilowatt

Five more companies have adopted "Reddy Kilowatt" to personalize electrical service (especially at the time a bill is presented). Those recently starting to use this symbol of "your electrical servant" are Connecticut Light & Power Company, Hartford Electric Light Company, Delaware Power & Light Company, Idaho Power Company and Gulf Power Company.

Prominent Utility Again Chooses

GOULD BATTERIES



Pennsylvania Power and Light Company adds another GOULD Planté battery to maintain dependable economical service.

NO public utility can afford to take chances on the failure of its operating control batteries. Circuit breakers, relays, indicating devices and emergency lighting equipment must always be ready for instant operation. The success of the entire control system depends on battery performance.

With these essential facts continually in mind, the Pennsylvania Power and Light Company has installed in its Northumberland sub-station the group of modern Gould Planté cells illustrated above. This installation consists of 60 Type NE-407 cells, with a rated capacity of 120 ampere hours at the 8 hour rate of discharge.

The inherent reliability and low cost operation of the Planté type battery reaches its highest development in four major features of construction, all exclusively GOULD. Insist on these four features of advanced construction and be assured of a modern Planté battery which gives extra dependability, extra long life, extra performance, and extra economy:

1. ONE-PIECE pure lead positive plate eliminates all the mechanical and electro-chemical difficulties which prevail in composite plate structures.

2. THE "GOULD Spun Plate Process" provides an exceptionally large surface area, and therefore a corresponding volume of active material. The spinning process also hardens and strengthens the metal, making each plate entirely self-supporting.

3. THE "GOULD C.P.," or chemically pure process, forms the active material over the entire surface area of each positive plate structure, without filling the interstices between the ribs. Large surface area made available to the electrolyte, assures high sustained capacity.

4. GOULD Dual Suspension design eliminates completely all misplacement or breakage of the cells parts. Covers of hard rubber, the ideal material, are free from mechanical stresses, hence no distortion throughout the useful life of the cell.

Send the coupon below for new illustrated book which gives all the interesting details of the GOULD Planté Type construction. It explains why these batteries are absolutely the most dependable and economical on the market. The book also contains valuable information on latest methods of battery operation and maintenance. No engineer or plant man should be without one of these manuals. Mail the coupon at once for your copy.

FREE: VALUABLE ILLUSTRATED BATTERY MANUAL

Gould Storage Battery Corporation
200 to 250 Neoga Street
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Please send me a copy of your new illustrated battery book, No. 950, described above.

Name.....

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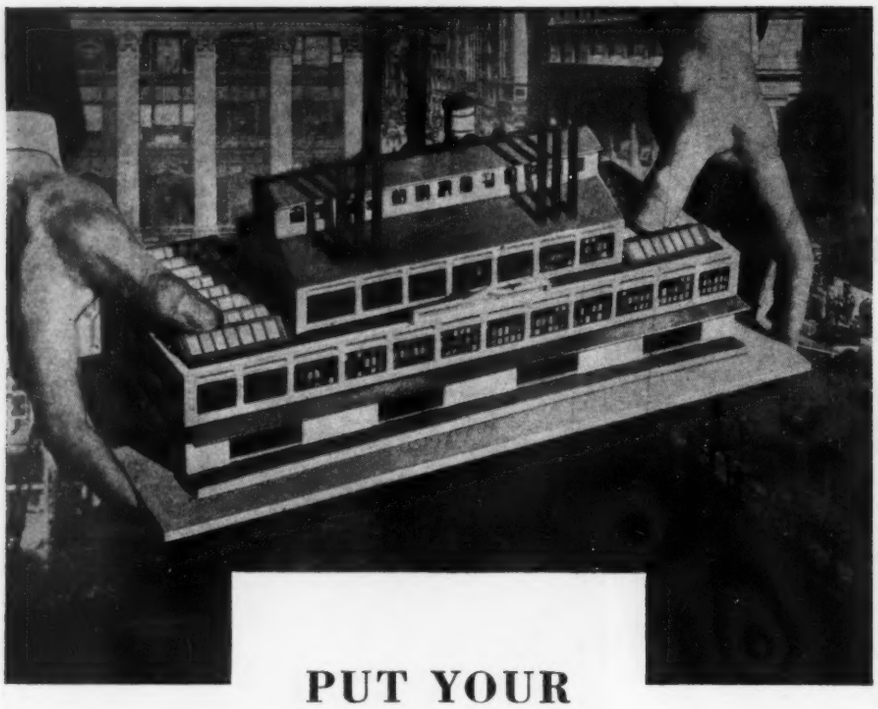


PUT YOUR

BUSINESS

in the midst of your customers

WHETHER you are a manufacturer or a merchant, the New York State territory served by Niagara Hudson System Companies offers you two big advantages.

ABUNDANT LOW COST ELECTRICITY—A PROSPEROUS MARKET

New York State is the heart of a region which comprises 49 per cent of the nation's people and contains 55 per cent of the nation's wealth.

The interconnected plants of the Niagara Hudson System—102 of them, hydro-electric and steam—insure an abundant, dependable supply of low cost electricity. Altogether they form a pool of 2,000,000 horsepower.

The offices of our principal operating companies in Albany, Syracuse and Buffalo are glad to cooperate with those interested in locating their business in this territory.

A permanent and progressive development policy

The Niagara Hudson System Companies have a permanent and progressive policy for the development of all business within their territory. For example, 45% of the farms suitable for permanent agricultural uses within franchise territory are now electrified. Over 500 miles of new rural distribution lines have been built in the past 6 months . . . and more than 2000 miles are planned for 1936. In 1935 the average farm and residential customer used 43.4 per cent more energy than in 1928 and paid 22.8 per cent less for each unit. Increased use of electricity means better living—better markets for your goods.

NIAGARA HUDSON

Port Washington Sets World Record

The Port Washington, Wis., power plant of the Milwaukee Electric Railway & Light Company established a new world record for economy of operation in steam generating stations, according to G. G. Post, vice-president in charge of power.

"Operating records for the first four months in which the plant has been in service show an average coal consumption of 11,412 B.t.u. per kilowatt-hour of station output, which is about 900 B.t.u. less than for the next best station," Mr. Post declared.

When the utility's Lakeside power plant was established, in 1920, it produced a kilowatt-hour for 21,000 B.t.u., and with further engineering improvements reached a mark of 15,266 B.t.u. in 1925, which was then the world record. After adopting generation by high-pressure equipment Lakeside's record was further improved to 13,009 B.t.u.

Both the Port Washington and the Lakeside plants were designed entirely by Milwaukee Electric company engineers. The Port Washington plant generated electricity for the first time October 14, 1935.

•

Underground Wire Row Reaches Impasse

Another meeting on the subject of putting utility wires underground in San Francisco broke up without action when committee members were reminded that any additional expense forced upon the Pacific Gas & Electric Company would have to be paid by the city if and when it purchases the local distribution system. Utilities Manager Cahill told the streets and utilities committee members: "Soak the Pacific Gas & Electric and it may turn out you are soaking yourselves."

Testimony was presented to show that placing wires underground costs the city for street lights $20,000 a mile, the P. G. & E. $57,000 a mile, the city, for signal wires, $5,000 to $10,000 a mile, and the telephone company about $7,500 a mile.

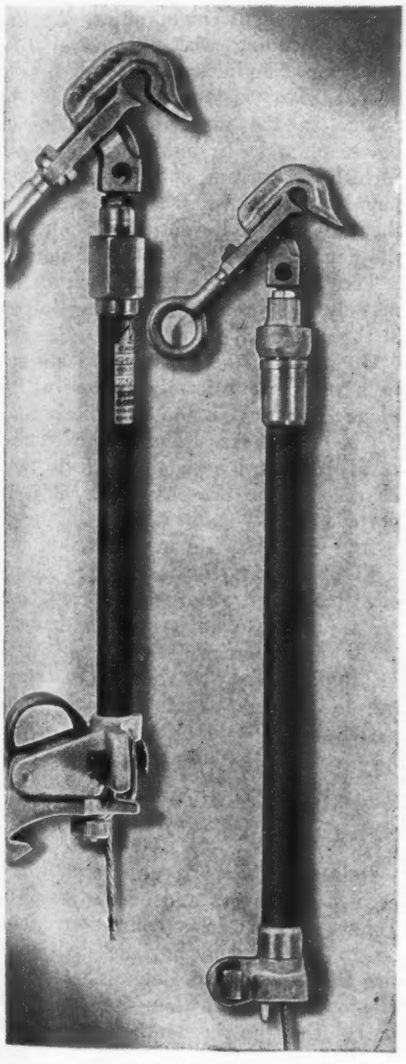
Mr. Cahill stated that he expected to be asked by the board to submit one or two more power distribution plans. He couldn't prepare them, he said, until he knew whether this additional $570,000 a year undergrounding cost is going to be loaded upon the local electric utility.

Eustace Cullinan, representing the Pacific Gas & Electric Company, declared San Francisco was "getting away with murder" in requiring 2½ miles of underground a year. "Ninety miles, 10 per

★

"Shatter-Proof" Insulation for Hot-Line Equipment

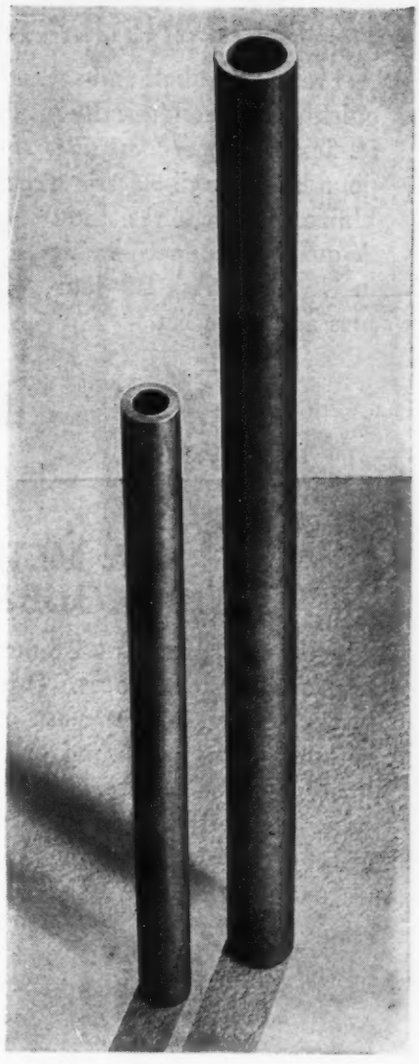
AMONG the many electrical insulations, Bakelite Laminated stands out as especially valuable for a large class of electrical devices and equipment because it possesses unusual strength and toughness in addition to high insulating value.



Consider, for example, the advantages obtained through use of Bakelite Laminated in the two Line Suspension Fuses, pictured. The tubular casings made from this material provide strong, rigid backbones for the units; they possess ample toughness to withstand the shock of sudden spring contraction when fuse links blow; and they insure complete insulation of end terminals until fuses are replaced.

Besides these properties, Bakelite Laminated offers the combined advantages of high resistance to moisture, outdoor exposure, heat and cold, oil, fumes and most chemicals. This laminated material is obtainable from stock in sheets of many thicknesses and in tubes and rods of various diameters and cross-sections. Special shapes are formed to order when necessary.

Other forms of Bakelite Materials include molded, of several types such as impact resistant, low-loss and high-heat resistant; and also insulating varnishes, enamels and cements. We invite you to consult our laboratories for information and cooperation on any proposed application of Bakelite Materials in designing electrical devices, appliances or equipment. For ready reference, write for copies of our illustrated booklets 3L, "Bakelite Laminated", 3M, "Bakelite Molded" and 3V, "Bakelite Varnish".



Photographs show the 7.5 KV—50 amp. Line Suspension Fuses with fibre-lined Bakelite Laminated tubes. Made by Schweitzer & Conrad, Inc., Chicago, Ill. and, above, the two types of tubes used in their construction.

BAKELITE CORPORATION, 247 PARK AVENUE, NEW YORK, N.Y.
BAKELITE CORPORATION OF CANADA, LIMITED, 63 Dufferin Street, Toronto, Ontario, Canada

BAKELITE

REGISTERED U. S. PAT. OFF.

"The registered trade marks shown above distinguish materials manufactured by Bakelite Corporation. Under the capital "B" is the numerical sign for infinity, or unlimited quantity. It symbolizes the infinite number of present and future uses of Bakelite Corporation's products"

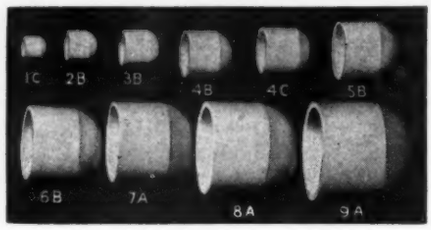
THE MATERIAL OF A THOUSAND USES

NEW PRODUCTS in PORCELAIN!

★

LAVOLAIN BEADS FOR INSULATING BARE WIRE

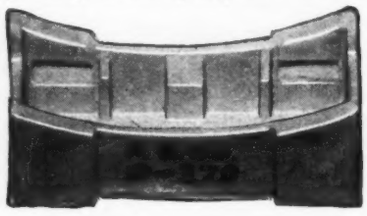
A brand new ball-and-socket insulating bead with which to quickly and economically insulate bare wire without destroying its flexibility. *Actual sizes shown.* Cost only a few cents per pound. High di-electric strength. Good mechanical strength. Uniform. Heat resistant. A quality product—made in U. S. A. Ask for samples and price list.



★

A METER SEAL THAT DISCOURAGES TAMPERERS

The Star Seal for type CS meters has been in use long enough to prove its effectiveness. It is a simple porcelain cap that clips into place, without the use of tools, and cannot be removed without badly mutilating or completely destroying it. Costs little. Carries serial number or other desired markings. Let us send samples—tell you who is now using Star Meter Seals.



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OTHER REFRACTORY AND INSULATING PORCELAINS

If you need refractory porcelains that will withstand rapid temperature changes for long periods try THERMOLAIN. If you need insulating parts with excellent mechanical as well as electrical properties we recommend LAVOLAIN. Let us quote on your requirements.

THE STAR PORCELAIN CO.

TRENTON, N. J.

cent, of San Francisco streets are in underground districts," Mr. Cullinan declared. "The figure is 3 per cent in neighboring cities. If this 10-mile requirement goes through other cities in this area will demand lower electric rates than San Francisco or will make similar undergrounding requirements, in which case all consumers' rates will go up."

•

Texas Applies for R.E.A. Allotment

One of the most extensive rural electrification projects in Texas under consideration at this time is that of constructing approximately 250 miles of transmission lines out of Bryan to furnish power and lights to scores of farms and small communities. Application is pending with the Rural Electrification Administration for a loan of $325,000 to install a new 1,000-hp. engine in the municipal electric and power plant at Bryan, which plant will furnish the current, collect the bills and pay the installments to the R.E.A. as they fall due, and eventually take title to the county-wide transmission system.

The loan may be paid back over a period of 20 years and will draw interest at the rate of 3 per cent.

Operation of the Bryan utilities is said to have been uniformly successful, the plant "earning" in the neighborhood of $70,000 per year. Rates to be charged rural users will be comparable to those charged within the city limits, it is reported.

In the Clarksville area Texas Power & Light Company has completed a rural electrification transmission system serving approximately fifty farms and several small communities. The company is making a survey with the view of extending the system to other parts of the county.

•

Toledo Edison Wins Safety Award

Industrial safety is an everyday concern of employees and executives of all Toledo plants. In a contest sponsored by the safety and hygiene division of the Ohio Industrial Commission 49,099 employees of more than 400 firms took part during the six months from October 1, 1935, to March 31, 1936, and they worked a total of 44,503,687 man-hours with only 853 reportable accidents in the period. The accident frequency was 18.94 accidents per million man-hours worked. Early in 1935 the rate was 26.5 accidents per million man-hours worked.

Toledo Edison Company won the bronze award for its record of only one reportable accident in the six-month period for 1,258,910 man-hours worked.

...*for* FAST, LOW COST, AND EFFICIENT POWER LINE CONSTRUCTION AND MAINTENANCE WORK *use the* . . .

HIGHWAY EARTH BORING MACHINE

Build and place new power lines in revenue bearing surface in less than half the usual time.

Replace, reset, and move pole lines on road widening projects at less than half the usual cost.

Restore storm wrecked lines to permanent service with less than half the usual delay.

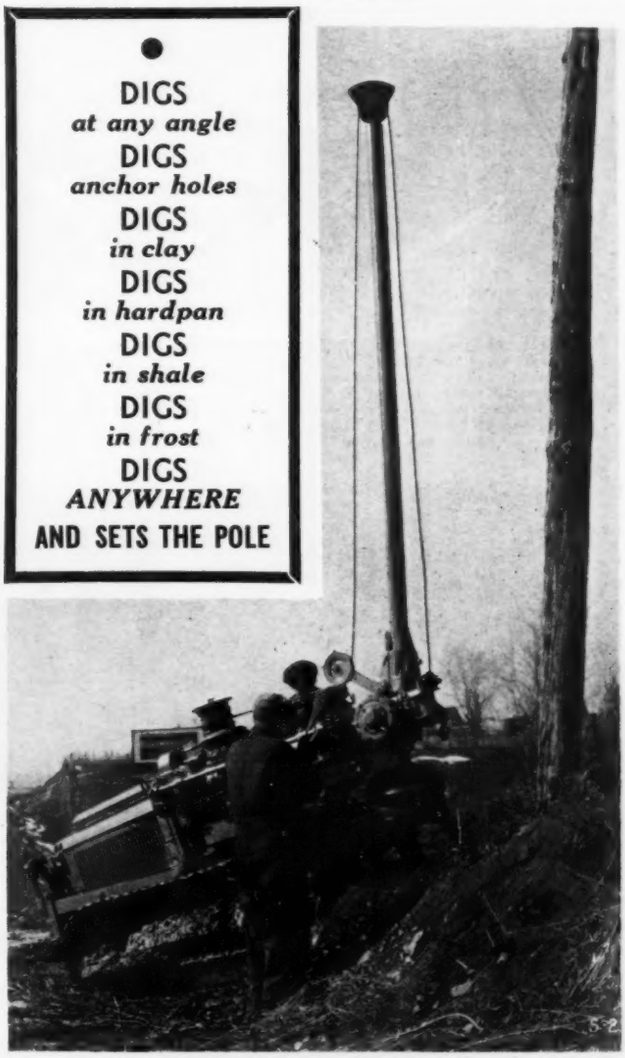
The Model D Earth Boring Machine mounted on truck or tractor (as illustrated) will dig holes from 6 to 20″ in diameter and 7′ deep in less than two minutes' time.

Averages 80 to 100 holes and poles in the ground per day in construction work. Resets or replaces an average of 40 to 60 poles per day in maintenance work.

Truck mounted machine will reach almost every location; over ditches and banks, along the highway or an average cross-country terrain and has the added advantage of traveling to and from the job at traffic speed. The pole setting derrick easily and safely handles poles up to 2500 pounds in weight and up to 45′ in height. Write for bulletin.

DIGS
at any angle
DIGS
anchor holes
DIGS
in clay
DIGS
in hardpan
DIGS
in shale
DIGS
in frost
DIGS
ANYWHERE
AND SETS THE POLE

The tractor mounted machine negotiates severe terrain conditions and reaches 98% of all locations—digs the hole anywhere and sets poles from 40 to 45′ in height weighing from 2000 to 2500 pounds. Write for bulletin.

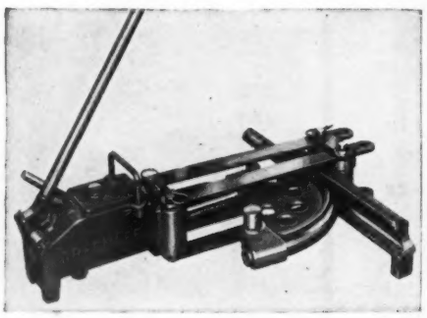


HIGHWAY TRAILER CO.
EDGERTON WISCONSIN

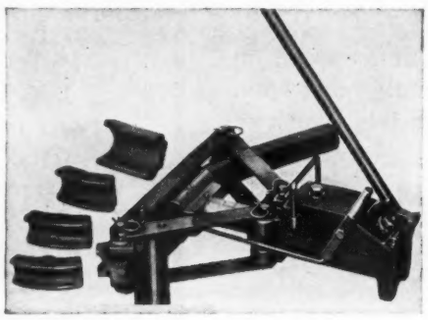
YOU CAN SAVE *time and money* WITH GREENLEE TOOLS

CONDUIT BENDERS • KNOCKOUT TOOLS • PIPE PUSHERS • BORING TOOLS

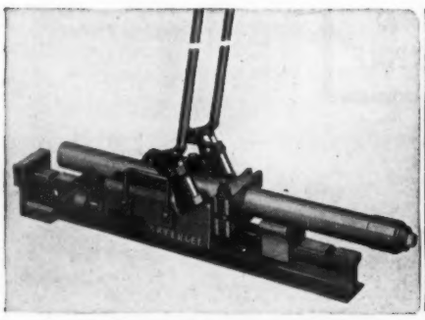
It is almost as important to have good tools as it is to use good construction materials. Savings are realized both ways. And on any job where conduit is to be bent, pipe pushed or knockouts enlarged, Greenlee Tools will soon pay for themselves.



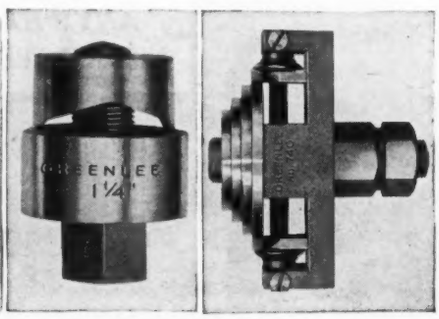
Above is the Greenlee No. 770-T Bender for thin-wall steel conduit. Same as No. 770, but with different attachments. Bends quickly and easily without crushing. Complete forward movement of the ram makes full 90-degree bend. Will handle 1¼, 1½ and 2-inch conduit.



Above is the Greenlee Hydraulic Bender for rigid conduit. It is simple to operate, easily portable, and makes bends quicker and better than by other methods. No. 770 bends all sizes from 1¼ to 3-inch. The large bender, No. 775, handles all sizes from 2½ to 4½-inch.



Greenlee No. 790 Hydraulic Pipe Pusher saves money on underground installation of pipe and conduit. Eliminates much trenching, back-filling, etc., and saves lawns and pavement. Easy for one man to operate. Will exert maximum pressure of 40,000 pounds on pipe clamp. Capacity for pipe from 1¼ to 4-inch.



Greenlee Knockout Tools enlarge holes for conduit quickly and accurately, without reaming or filing. Convenient to operate. Punches come in two sets. No 735 is for ½, ¾, 1 and 1¼-inch conduit, while No. 737 is for 1½ and 2-inch conduit. No. 740 Cutter will enlarge holes for 1½, 2, 2½ and 3-inch conduit.

Take the Hydraulic Conduit Benders as an example. They make better bends easier and in less time than by any other method, and they make it easy to pull in wire and cable. By using a Greenlee Hydraulic Pipe Pusher much trenching, back-filling, etc., can be eliminated. All that is necessary is to make a trench long enough to accommodate the pusher with a section of pipe, and one man can send it where it is wanted, simply by pumping the levers.

Write Now For Complete Information. No Obligation, of Course.

GREENLEE TOOL CO., *1705 Columbia Ave.,* **ROCKFORD, ILL.**

Hearings Open on Hydro Pacts

Validity of the Ontario Government's legislation canceling certain contracts for electric power from Quebec is now being put to the test at the sessions being held in Toronto, where Chief Justice Hugh E. Rose is hearing the first of several actions against the Hydro-Electric Power Commission of Ontario.

The Ottawa Valley Power Company, plaintiff in this action, with Joseph G. Singer and other bondholders, primarily seeks a declaration that the Power Commission Act of 1935 does not apply to the contract between it and the commission. Besides seeking a declaration that the legislation is invalid, the power company is seeking $115,000 from the commission for power available under contracts at December 6, 1935, when the legislation was proclaimed.

J. J. Symington, general counsel for the power company, told W. N. Tilley, appearing for the plaintiffs, that the contract his company had with Hydro was the only one it held. It would be impossible to sell power to Quebec, as 60 cycles are used in that province and the machinery set up by the company was for 25 cycles for Hydro use, the witness said. The joint development agreement had been drawn up so that "they were workable together and unworkable apart." "The whole character of the joint development—the installation and everything—made necessary a joint arrangement whereby one party used all the power," he said.

Mr. Symington testified that he had taken part in the negotiations leading up to the contracts between the company and the commission, which was to take all the power from the Chats Falls joint development. Although the Chats Falls plant is still operating, no power is now being taken, he said. A list showing the payments made by Hydro from October, 1931, until the contracts were canceled showed that the commission had paid some $5,000,000.

•

West Penn Extension

Electricity will be made available for more than a hundred Taylor county rural families within the next 90 days, Harold McMillen, Grafton manager of the Monongahela West Penn Company, has disclosed, in announcing the start of construction of two new lines that will bring current to farms along their path. The line for the use of the contractors on the Berkeley Run railroad relocation project is now being constructed, he states.

The lines are being built at an approximate expense of $20,000 and will give employment to eight men in addition to the regular crews.

FLASH!

ANNOUNCE OZALID-WICKES PORTABLE SELF-CONTAINED COMBINED PRINTER-DEVELOPER FOR MAKING OZALID WHITE-PRINTS...

REVOLUTIONARY NEW DEVELOPMENT..OZALID WHITE-PRINTS AND TRANSPARENT DUPLICATES MADE IN TWO STEPS ONLY..EXPOSURE AND DRY DEVELOPMENT..

HANDLES ALL OZALID MATERIALS...USED IN ANY OFFICE..MOST SWEEPING ADVANCE EVER MADE IN TECHNICAL REPRODUCTION FIELD..LOW IN FIRST COST..

EXCEPTIONAL ECONOMIES.... INVESTIGATE AT ONCE .....

Ozalid — Wickes Portable Self-Contained

Trade Mark Reg U.S. Pat. Off

COMBINED PRINTER DRY DEVELOPER

Here at last is a self-contained printing and developing unit that brings you *all* the advantages of the modern **OZALID WHITE PRINTING PROCESS** . . . the only complete technical reproduction process producing positive white prints on a full range of standard and lightweight papers and cloths and also producing transparent duplicates on tracing paper or cloth in two steps only and without the use of Van Dykes.

OZALID Sensitized Materials reproduce in Blue, Black, Maroon or Sepia line on a **WHITE** ground. No moisture touches the prints at any time . . . hence they are absolutely true to scale.

With this new portable combination machine you have the most complete and flexible reproduction process at your command, right in your office, ready for instant action, easily operated by any ordinarily careful person.

Fill in and mail the coupon at once. Be one of the first to enjoy this outstanding accomplishment.

MAIL THIS COUPON TODAY

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354 Fourth Avenue, New York, N. Y.

Please send at once literature covering both the New "Type 600" Ozalid Dry Developing Machine, the "Type 2000" and the New **OZALID-WICKES PRINTER-DEVELOPER.** Also full details of the **OZALID WHITE PRINT PROCESS** together with samples of prints and prices of machines—All without obligation.

Name .....

Company .....

Address .....

Edison Service *in* *Chicago*

REVENUES from the sale of electricity by the Commonwealth Edison Company in 1935 amounted to $78,533,303.58, an increase of 4.1 per cent over 1934.

Kilowatt-hours sold in 1935 amounted to 3,682,862,000, an increase of 4.2 per cent over 1934 and only 3.6 per cent under the Company's record total of 1929.

The maximum load of the Company's system amounted to 953,000 kilowatts, an increase of 6.8 per cent over the maximum load in 1934 but 4.7 per cent under the record of 1929.

The gross number of customers at the end of 1935 was 931,600, a gain of 6,400 for the year. This was 57,400 greater than the low point in May, 1933 but 20,000 less than the record total of January, 1930.

The average annual use of electricity by residential customers (including consumption of residential hall-lighting customers) in 1935 amounted to 792 kilowatt-hours as compared with 766 kilowatt-hours in the previous year.

The total number of stockholders of the Company at the end of 1935 was 61,258, of whom approximately 86 per cent live in Illinois and 72 per cent in Chicago.

•

A copy of the annual report of the Company for 1935 will be sent upon request addressed to the Secretary.

COMMONWEALTH EDISON COMPANY

72 West Adams Street, Chicago, Illinois

Indiana Rural Lines to Forego Easements

A speed-up in construction of rural electrification lines is expected following an opinion of Philip Lutz, Jr., Indiana Attorney-General, to the secretary to Gov. Paul V. McNutt. The secretary, at the request of the Indiana state-wide rural electrification organization, had asked whether it was necessary for the federal government to obtain easements from owners of abutting property along proposed electric lines. The Attorney-General said the placing of such lines (on state highway rights-of-way) placed no additional burdens on the abutting property owners and that easements were not necessary. Otherwise considerable red tape might have been encountered in obtaining such authority from these property owners, it was said.

Four new rural electric corporations filed charter papers recently with the Secretary of State. They are the Wabash County, Whitley County, Huntington County and Boone County corporations.

•

Revenue Bonds Urged for Municipal Plants

Revenue utility bonds (principal and interest payable from revenues of municipal power plants but constituting no lien against the city) have become a political issue in Oklahoma. Petitions seeking an initiative vote for a constitutional amendment authorizing such bonds now are being checked for validity of signatures before the state Supreme Court.

•

Specifications Approved For I.E.S. End Table Lamp

Specifications for a new reading lamp which can be used on low end tables were approved recently by the Illuminating Engineering Society. Specifications for the new lamp are quite different from those covering the well-known study lamps since it is more essentially a direct lighting device than the study lamp.

For example, the upward component of light from the new lamp has been specified as 10 per cent, with the total light output of no less than 65 per cent

Illumination Specifications for I.E.S. End Table Lamp

Distance from Base Inches	End Table Lamp	Study Lamp
	Foot Candles	
18	25	20
24	20	10
30	10	7

WHY You Should Look Into Your Method of Bill Analysis

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has been introduced by the R. & S. Bill Frequency Analyzer, created especially for our Public Utility Rate Service . . . **LOWER COST** is assured without hazardous "short cuts" because the entire operation is reduced to a single step . . . **GREATER SPEED** makes the preparation of monthly or annual bill-frequency tables a matter of days instead of weeks and months, without employing temporary or emergency personnel . . . **CONTROLLED ACCURACY** does away with the need for re-checking and re-analyzing common to previous machine or hand methods . . . **DIRECT COMPILATION** from your billing register or other customary record eliminates advance preparation, field work, disruption of routine.

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Everstick Anchors are available in 2-way, 3-way and 4-way types in fifteen sizes to meet all strain requirements. The Everstick 3-way Base Plate shown here is designed to carry 100% excess strains and to meet all soil conditions without distortion or bending.

THE EVERSTICK ANCHOR CO.

Manufacturers of Everstick "The Anchor of Merit"

FAIRFIELD, IOWA

of the light output of the bare unshaded bulb. This minimum is 10 per cent lower than that for the study lamp.

Slightly higher values of illumination on the working plane have been specified for the new lamp, as is evidenced by the accompanying table, which is based on the use of a standard 100-watt bulb.

•

Homes Receiving Electric Service

Statistics on the number of domestic customers in each county and city in the United States were prepared jointly, several years ago, by the National Electric Light Association and the Electrical Division of the Bureau of Foreign and Domestic Commerce. This compilation has now been republished by the Electrical Division as one of the series entitled "World Power Manual and Electrical Exporters Handbook."

Frequent inquiries show that there is a demand for this detailed information for purposes of market analysis. The fact that the figures are about five years old is a minor objection, for the number of domestic customers diminished after 1930 and the subsequent increase brought the nation-wide total at the end of 1935 only 3 per cent above the number recorded five years earlier. This rate, of course, does not apply to each individual locality considered by itself, but the differences in most instances probably are not serious. In any event, the data are the latest available, and in the new form they are more convenient for reference than the large sheets originally issued.

•

Sacramento District Upheld by California Court

Validity of the $12,000,000 bond issue voted by the Sacramento Municipal Utility District in November, 1934, for the purchase or erection of a light and power system has been upheld in a decision handed down by the California Supreme Court recently. The decision was over the protest of Pacific Gas & Electric Company, F. P. Brendal and L. H. Hough, as property owners. The district comprises 650 square miles in Sacramento and Placer Counties, all served at present by the Pacific Gas & Electric Company.

•

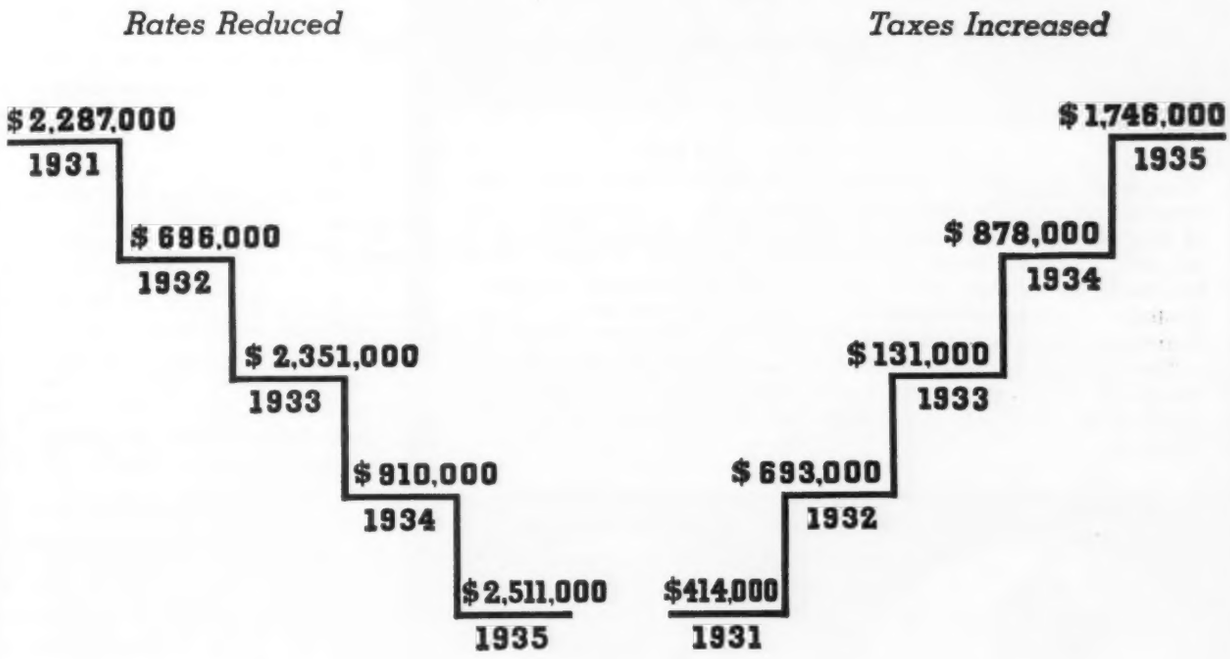
Kettle Falls Hearing

Announcement has been made by the Federal Power Commission that a public hearing will be held on May 25 on the application of the Washington Water Power Company for license for Project 229 at Kettle Falls on the Columbia River in Washington. Kettle Falls lies

Rate Reductions

or

Taxes



Rates for utility service to the customers of U. G. I. System Companies were reduced $8,755,000 in the five year period from 1931 to 1935, inclusive.

In that same five-year period taxes of those companies increased $3,862,000.

A continuation of this steady ***upward*** trend of taxes, an increase of 50 percent within five years, will impede the steady ***downward*** progress of rates.

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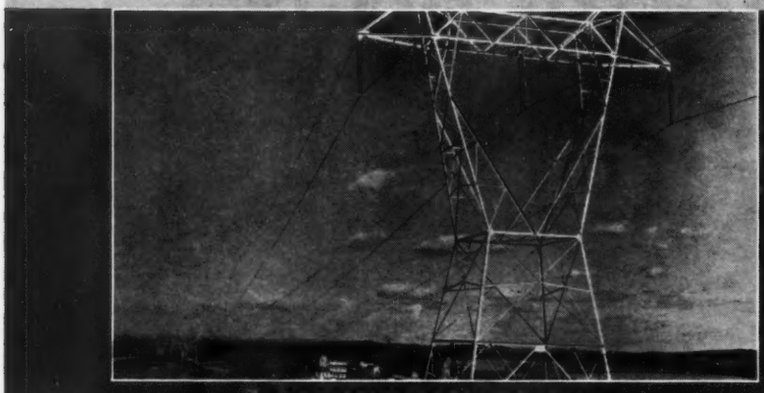

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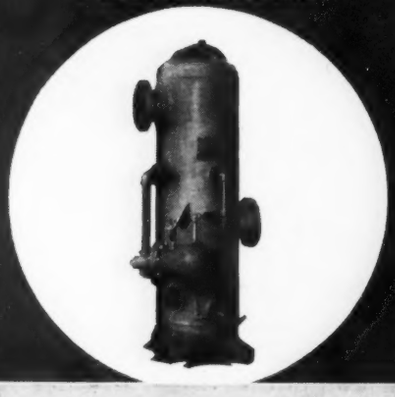
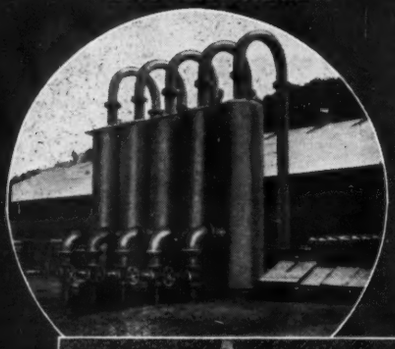
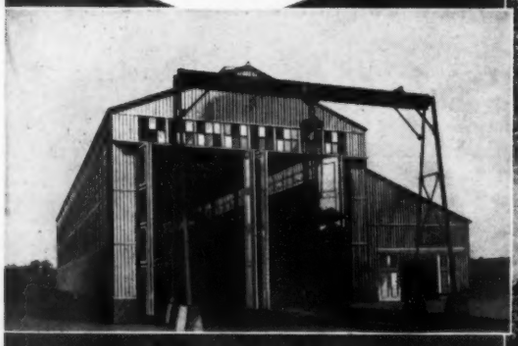
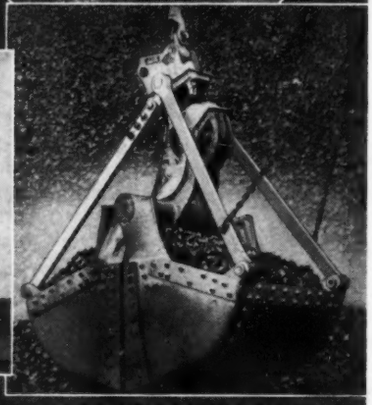


GAS CLEANERS





STEEL BUILDINGS



CLAMSHELL BUCKETS

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between the Grand Coulee project and the Canadian border. The Columbia Basin Commission has expressed objection to construction of the Kettle Falls project. In addition to the possible physical conflict between the Grand Coulee and Kettle Falls projects, there is also the question of the disposition of the power to be generated at Kettle Falls, the objectors claim.

•

Municipality Owns Hydro Project

In an amended application filed with the Virginia Corporation Commission the city of High Point, N. C., was revealed as the owner of the Smith Mountain Power Company, which early this year applied to the Federal Power Commission for a license covering a hydroelectric project on the Roanoke River at Smith Mountain, Va. (ELECTRICAL WORLD, January 11, page 4). The amended application listed the estimated cost at $8,088,241, compared with an original estimate of $4,486,971.

High Point has applied to P.W.A. for a 45 per cent grant for the project and will finance the remaining 55 per cent with bonds secured by a first mortgage on the proposed plant and a first lien on its revenues, the application states. The commission ordered the amended application filed for a hearing already set for June 1.

At a preliminary hearing in February on the first application opposition was expressed by the Virginia Public Service Company, Appalachian Electric Power Company and certain landowners near the site of the projected development. As amended the application now says that "no current will be sold in Virginia except at wholesale and without conflict with the franchise or other rights of any distributing agency."

•

Grange Power Law Held Constitutional

Clearing away the last legal obstacle to the establishment of publicly-owned power systems in the State of Washington, the Supreme Court in an eight to one decision handed down last week held the 1934 Grange power district law constitutional.

The power law allows districts to vote on the establishment of publicly-owned power systems. Power may be created by the district or purchased from generating plants owned by companies, other districts or cities. Several districts have already been formed in the state and a number of others are expected to be voted upon at the fall general elections.

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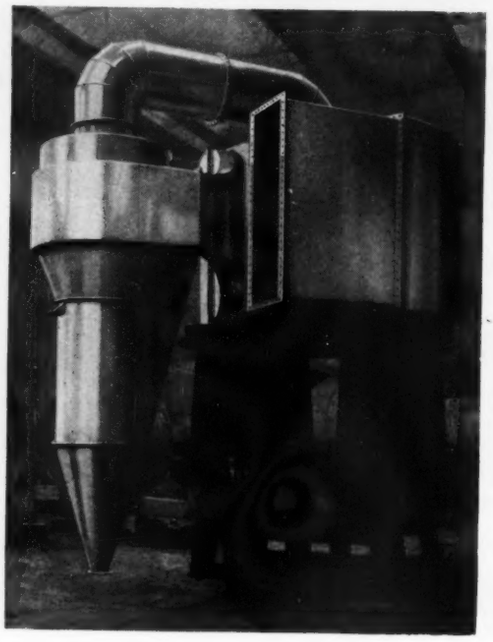
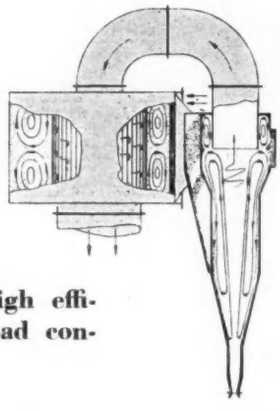


Buell Dust Collectors establish new standards of efficiency in FLY-ASH REMOVAL from stack gases of Pulverized Fuel and Stoker-Fired Boilers.

●

Unusually low pressure drop.



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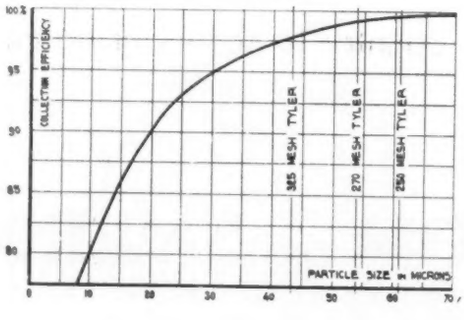
Simplified control maintains high efficiencies over widely varying load conditions.



Typical curve of collection efficiencies at pressure drop of less than 1.75" W. G.

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SALES OPPORTUNITIES IN NEW CONSTRUCTION

ARCADIA, OKLA. — Oklahoma Gas & Electric Company, Oklahoma City, plans new 13,200-volt transmission line from Edmond to Arcadia, about 10 miles; also new transmission line in Garfield County, vicinity of Enid, Okla., about 5 miles. Cost about $55,000.

FERNANDINA, FLA. — Container Corporation of America, Inc., 111 West Washington Street, Chicago, Ill., plans installation of motors and controls, machine drives, transformers and accessories, regulators, conveyors and other equipment in new multi-unit kraft pulp and paper mill at Fernandina, where tract of land has been acquired. Also plans power plant for mill service. Entire project will cost over $5,000,000. George F. Hardy, 305 Broadway, New York, N. Y., is consulting engineer.

SPRINGFIELD, OHIO — Ohio Edison Company, Springfield, plans transmission and distributing lines in Salem, Fairfield, Perry, Elkrun, Unity and other townships in Columbiana county, including power substation and service facilities. Cost over $85,000.

BROOKLYN, N. Y.—Signal Corps Procurement District, Army Base, Fifty-eighth Street and First Avenue, receives bids until June 5 for 400,000 feet of wire, 7,000 feet of cable, and two reels (Circular 225).

COLFAX, WASH. — Washington Water Power Company, Spokane, Wash., plans new 110,000-volt power substation at Colfax, replacing present 60,000-volt station on Clay Street, and will remodel latter for other service. Surveys have been authorized for new 13,000-volt transmission line from Colfax to Diamond, Wash., and for improvements and replacements in existing transmission line between Colfax and Lind, Wash.

NIAGARA FALLS, N. Y.—Union Carbide Company, Forty-seventh Street, plans installation of motors and controls, conveyors and other equipment in connection with expansion and improvements in plant. Cost close to $1,000,000. Company is a subsidiary of Union Carbide & Carbon Corporation, 30 East Forty-second Street, New York, N. Y.

JOHNSON CITY, TENN.—Has engaged Lide & Adler Company, Woodward Building, Birmingham, Ala., consulting engineer, to make surveys and estimates of cost for city-owned electrical distributing system, with power substation and transmission lines for connection with system of TVA for power supply.

MARSHALLTOWN, IOWA — Iowa Electric Light & Power Company, Cedar Rapids, Iowa, plans new transmission lines in portion of Marshall County. Application has been made for permission.

CHICAGO, ILL.—Purchasing Officer, Department of Interior, 1749 West Pershing Roads, receives bids until June 8 for electrical supplies for fiscal year 1937, including quantities of weatherproof wire, rubber-covered wire, fuse wire, switches, switch boxes, armored cable, sockets, receptacles and other supplies (Schedule 26).

COLUMBIA, S. C.—State Rural Electrification Authority, 1539 Main Street, Columbia, will take bids at once for transmission and distributing lines in Pickens, Spartanburg, Greenville, Darlington, Anderson, Aiken and other counties for rural electrification, comprising two groups each totaling about 200 miles, with power substation and service facilities. Entire project will cost close to $375,000. Authority has awarded contract to W. E. Callahan Construction Company, Dallas, Tex., for constructing 147 miles of similar power lines in group of 11 counties, at price of $105,000.

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TOPPENISH, WASH. — Has authorized surveys and estimates of cost for installation of improved street-lighting system on main streets.

SAN FRANCISCO, CALIF. — Bureau of Supplies and Accounts, Navy Department, Washington, D. C., receives bids until June 5 for 150,000 feet antenna wire for Mare Island Navy Yard (Schedule 7953).

COLUMBIA, TENN. — Monsanto Chemical Company, 1700 South Second Street, St. Louis, Mo., plans installation of motors and controls, machine drives, conveyors, transformers and accessories, electric hoists and other equipment in new phosphate refining plant in vicinity of Columbia. Cost over $1,000,000.

COLUMBUS, NEB.—Loup River Public Power District, Columbus, C. B. Fricke, president, plans early construction of about 49 miles, 12,000-volt transmission lines and 305 miles, 690-volt distribution lines, with power substation and service facilities. Cost about $400,000. Fund of $391,000 has been secured through Federal aid.

SHELBYVILLE, IND. — Shelby County Rural Electric Membership Corporation, recently organized by Lewis Patterson and K. Hord Gordon, Shelbyville, and associates, plans transmission and distributing lines in portion of Shelby County for rural electrification, including service facilities.

DENVER, COLO. — Bureau of Reclamation, Denver, receives bids until May 28 for steel cable racks and supports for Boulder power plant, Boulder Canyon Project, Arizona - California - Nevada (Specifications 795-D).

ALMA, MICH.—Northern Refineries, Inc., Alma, recently organized care of E. G. Guy, Mount Pleasant, Mich., engineer, plans installation of motors and controls, conveyors, electric pumping machinery and other equipment in new oil refining plant on 20-acre tract of land. Cost over $100,000.

GREENWOOD, S. C.—Greenwood County Finance Board of County Commissioners, Greenwood, Daniel T. Duncan, engineer, in charge, is arranging call for bids for construction of transmission and distributing lines in Greenwood and adjoining counties for rural electrification, totaling about 100 miles, with power substation and service facilities. Cost about $175,000, of which $130,000 has been secured through Federal aid.

TOLEDO, OHIO — Libbey - Owens - Ford Glass Company, Nicholas Building, Toledo, plans installation of motors and controls, conveyors, regulators and other equipment for expansion and improvements in sheet glass plants at East Toledo and Rossford, Ohio. Entire project will cost $700,000.

WASHINGTON, D. C.—Bureau of Supplies and Accounts, Navy Department, Washington, receives bids until May 29 for nine electric furnaces for Eastern and Western Navy Yards (Schedule 7908).

WOOSTER, OHIO—Central Ohio Light & Power Company plans new transmission and distributing lines in portion of Holmes County for rural electrification, including service facilities. A new power substation will be built at Wooster.

SEWARD, ALASKA—Receives bids until July 20 for municipal hydroelectric power plant on Lost Lake, including two 375 kva. water turbine-generator units, with alternate bids on one 500-kva. hydraulic turbine unit, and complete accessories, power substation and auxiliary structures; also for transmission line to Seward from station site, about 11 miles, and for electrical distribution system, with step-down power substation at town limits. Fund of $140,000 available. Hubbell & Waller Engineering Corporation, Alaska Building, Seattle, Wash., is consulting engineer.

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BOOK REVIEWS

Legal and Ethical Phases of Engineering

By Harding & Canfield. Published by McGraw-Hill Book Company, 330 W. 42d Street, New York City. 430 pages. Price, $4.

Practicing engineers of all degrees of maturity will admit they encounter law in their contractual relations and have to deal steadily with specifications and estimates as well as the provisions and limitations of patents. They buy and sell, employ labor in more or less hazardous activities and, as employees of regulated utilities, have to deal with the general public. Beyond this, they deal with one another in the realm of professional ethics. All these areas of the law and equity are set up here in terse but simple language that is well illustrated by case citations that bring out the essence of principles as they pertain to engineering. Each chapter of this Purdue textbook ends with case problems that emphasize the importance of legal conformity in engineering practice.

Many engineers will wonder why their alma mater did not have such a course in their curriculum as they appreciate the way in which this book remedies the omission.

The last third of the book embraces appendices devoted to typical specification forms for electrical equipment purchasing (including line material) and for wiring installations. There are also abstracts of sales acts and compensation laws. There is a complete set of architect specifications for a private residence.

•

Mercury-Arc Rectifier Practice

By F. C. Orchard. Published by Instruments Publishing Company, Pittsburgh, Pa. 222 pages, illustrated. Price, $5.

In order to be of maximum benefit to all plant and operating engineers, a book on rectifiers could omit most of the mathematics of the arc and all of the manufacturers' literature on specific rectifier equipments. This book does that nicely and directly after devoting a chapter to fundamentals of mercury arcs and transformer connections. Subsequent chapters deal with design and assembly of the conventional rectifier and its accessories and of the building to house them. Testing and inspection technique are followed by a long chapter on operation and maintenance. Grid control is accorded a full chapter and then there follows a qualitative discussion of the merits and limitations of both rotary conversion and rectification. The British author discloses a competent familiarity with American thinking and practice.

•

Radio Receiving and Television Tubes

By Moyer & Wostrel. Published by McGraw-Hill Book Company, 330 West 42d Street, New York. 635 pages, illustrated. Price, $4.

Rewritten after five years phenomenal progress in tube development, the book is again up to date, much now irrelevant material having been abandoned in favor of the modern galaxy of tubes. Fabrication technique, fundamental electrophysical background and internal tube phenomena are

followed by testing procedure and the various functional applications of tubes in radio and industry. There is a good chapter on television tubes. This text is a comprehensive round-up of why tubes work and how their electronic characteristics can be put to tangible specific purpose. Circuit diagrams show the assemblies needed to derive the functional performance and the book is thus as much a handbook as a text.

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Regulation of Public Utilities in New Jersey

By M. C. Waltersdorf. Waverly Press, Inc. The Williams & Wilkings Company. Mt. Royal and Guilford Avenues, Baltimore, Md. 218 pages. Price, $2.50.

Students of regulation will find this a copiously annotated review of the evolution and present tenets of the New Jersey Board of Public Utility Commissioners. It aims to disclose the derivation of authority and the technique of applying it over the whole gamut of commission jurisdiction. In doing this the author intersperses his personal opinion in such manner and degree as often to becloud what he is attempting to portray. In spite of this fault, the book makes a good source of condensed practices and philosophy as applied in one state.

In the summary, the author holds out against the quasi-judicial concept and attributes the board's lack of initiative to that misguided stand. He also is a "people's counsel" advocate, but does not lean arbitrarily toward public ownership as the escape from private ownership abuses. He scents a defect in inadequate control over operating expense details. Unfortunately for the prestige of the book, he refers to Thomas F. Carter as president of New Jersey's largest utility, who is T. N. McCarter.

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Standard Practices

Published by Diesel Engine Manufacturers' Association, 192 Lexington Avenue, New York City. 162 pages, illustrated. Price $2.00.

Sixteen manufacturers here set down their standard terminology, specifications, selection guide, installation and analysis for the Diesel engine. The book deals primarily with the heavy-duty, low- and medium-speed stationary engines of 200 hp. and larger. The aim is to help the user and his consulting engineer apply properly the uniform principles and practices that pertain to the performance and sale of Diesels. Utility power sales engineers will be interested in the code which governs the dealings in situations which, for them, are often competitive. The last issue was five years ago.

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Advanced Laboratory Practice in Electricity and Magnetism

By Terry and Wahlin. McGraw-Hill Book Company, 330 West 42d Street, New York City. 318 pages, illustrated. Price, $3.

In its third edition, this text adds to the former 50 experiments, one on determination of the electronic charge and one on the thermionic work function of a metal, as well as rewriting of the electronic tube experiments. Professor Terry held to the laboratory method of instruction and this edition sticks to the scheme of leaving to the experiment all but what must be injected in introductory and liaison subject matter. The experiments are the customary electrical ones incorporated in the physics or elementary electrophysics course.

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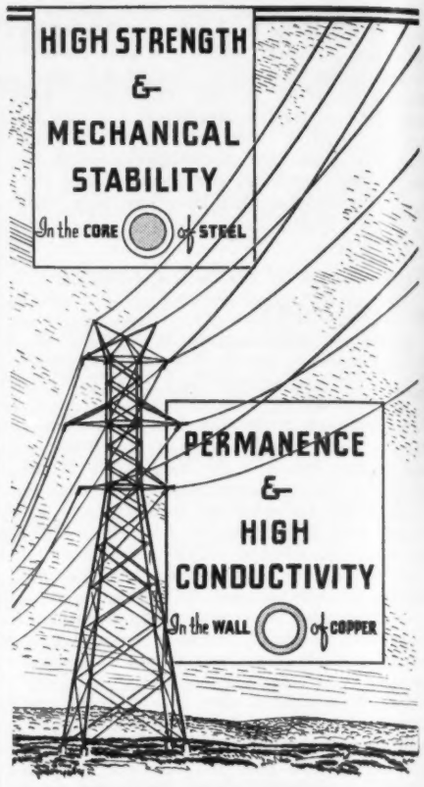

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